Concept of Urasta Hridaya (Heart) According to Ayurveda
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ABSTRACT
Hridaya (heart) is considered as one of the vital organ of the body by Ayurveda. Since it is one among the Trimarams and is regarded as Dasha prana ayatana, any injury to the Hridaya results in causation of grave diseases, severe complications or and even death. A vigilant study reveals that, two organs share approximately equal claims to put themselves identical with the term Hridaya which denotes an organ controlling the passage of Prana by collecting, distributing in a rhythm. At one end is the notion that Hridaya refers to brain, at the other end of the scale, it is the view that Hridaya is heart. As per Ayurvedic text, Hridaya is not only an organ that pumps blood, but also something with much wide area of action. Ayurvedic classic mentions that Hridaya is that which controls body, mind and senses, in addition is a seat of the intellect and vitality. Therefore it is essential to understand this organ thoroughly; however, Acharya Charak and Acharya Sushruta considered Hridaya as one among the Kosthangas and one among Kosthas respectively. These descriptions certainly indicate Hridaya as the ‘Urasta hridaya’. The present review article draws attention towards the concept of Urasta hridaya i.e., heart considered in Ayurveda.

INTRODUCTION
The term ‘Hridaya’ was first described in Atharva Veda and was considered as an organ system including Shirastahridaya i.e., brain (cranial hridaya) and Urastahridaya i.e. heart (thoracic hridaya). Yogavishistha clearly mentions that there are two Hridayas, one is thoracic and other is in head. The word ‘Hridaya’ is derived from three Dhatus (verbs) as per Satpathbrhaman and Brihadaranyak viz, ‘HRU’- means Harati (to receive from) or to abduct, ‘DA’- means Dadati (to give) or to donate. ‘YA’- means Yagati (to control) or ‘in gatou’ self generated rhythmicity for contraction and relaxation.

Thus the word Hridaya itself expresses its function, i.e. Hri- the suction activity of Hridaya (i.e., venous return), Da- he pumping activity of Hridaya (i.e. supply of oxygenated blood), and Ya- control of these above two functions. Thus Hridaya is the organ in the body which receives, gives out and is in a state of motion, the indication is to the organ heart. The Hridaya is engaged in contraction and relaxation ceaselessly during waking and sleep. This action continues even during sleep albeit at a slower pace but continue it does.

The concept of Hridaya is well illustrated in ‘Arthe Dash Mahamuliya Adhyaya’ and ‘Trimarmiya Adhyaya’ of Charak Samhita and in ‘Garbh Vyakarana Shariropkramnitya Adhyaya’ of Sushrut Sharir Sthana. The Hridaya is a type of Siramarma (based on constitution)[1] as Hridaya gives Rasa, Rakta and Oja to entire Srotas of the body through Siras like that of the mountain ranges which provide water and by this...
means nutrition and life to the whole world through rivers.[12] Vagbhata has stated Hridaya as Moola of Siras[3] and Siras are Rakta-updhatu. It is Sira marma since Sira (vessels) is the result of interaction between Rakta and Medas, the abundance of vessels is obvious in the heart. According to Ayurveda, the Hridaya originates from the essence of Shonita i.e., Rakta and Kapha and develops into a muscular organ (which can be correlated with myometrium). [4]

Marmas are the points spread over the human body where all the twelve Pranas reside in various concentration (Prana sthana) so they are vital for continuation of life processes. Shiras (head), Hridaya (heart) and Basti (urinary bladder) are Trimarmas. Even today cerebral death, cardiac arrest and renal failure ultimately lead to death. Acharya Charak also designated Hridaya as one of Trimarma and Dasavisheshyaayatanas,[5] and Acharya Shushrut mentioned Hridaya as Marma sthan of Sadhyapranhar variety (based on prognosis of injury i.e., vital organ and if affected, may cause instantaneous death) [6]. They have concluded this region as Pranayatan. The word Pranayatan is formed by two words – Prana (life) and Ayatana (Ashrayasthana -Seat). Accordingly Pranayatan is a vital part of the body and is a seat of life therefore its trauma or complication lead to death. Hridaya was also stated as Pranayatan and Mahamarma by Acharya Kashyapa.[7] It is the site of Chetana and manas as well as all the other Pranas hence it is considered as Mahamarma by Charak. This Urastha hridaya in Samhitas was considered to be hollow organ an Aashaya, [8] and a Kostha[9] as per Sushruta and a Kosthangal[10] as per Charaka and Vagbhata.

While describing the location, Acharya Sushruta states that Hridaya is situated in between the two breasts, in the chest above the mouth of the stomach. Moreover while explaining Garbh Vyakarana Sharir (embryology) he states that Pleeha (spleen) & Phuphus (lung) are placed below the left side of the Hridaya whereas Yakrut (liver) and Klove (mediastinum) are situated below the right side of the Hridaya. Similarly Aacharya Sharangdhhar mentioned that Hridaya is located in the thorax between breasts.

The dimensions are about 4 Anguli or about the size of individual’s fist. It is made up of Bahala and Shlakshna type of two Peshis as it has to initiate its work in mother’s womb and continues ceaselessly throughout the life till death. Therefore heart has very complex and efficient muscle structure. It has three Mandala Sandhis. The valves are circular in nature and control the flow of Rasa Rakta complex in and out the flow of the heart. Sushruta has called these as Sandhi/joint as they permit unidirectional movement of body constituent. In Aamavata mobile joints are swollen and painful and its complication is valvular disease of heart.

It has a shape of Adhomukha pundrika, i.e., inverted lotus whose apex is directed downwards.[13] Ten Mahadhamanies i.e., pulsating vessels are connected to it which supplies blood, nutrition, oxygen and thus immunity to the entire body.

Thus above references clarifies the matter once and for all and resolve the controversy about the cranial and thoracic heart. Therefore it can be stated that anatomically, physiologically and functionally Urastahridaya is similar to that of heart.

Genetically, it is the maternal organ [14] meaning that the heart forming part of the fertilized ovum comes from the mother as it is soft, pliable, contractile and expandible. In the second month of intrauterine life the heart bud is produced from the clear and pure portion of Rakta, Mansa and Kapha. By the fourth month the evolution of full fledge heart from a bud is completed [15] and then the mother is known as Dvihridaya (one who has two hearts). Since it is the abode of Atma, Manas, it reveals various desires called as Daahrida which should be fulfilled. Failure to fulfill them could result in congenital diseases including cardiac disease.

**Hridaya and Dosha-Dhatu and Mala**

The functions of Hridaya are due to Vayu, specially Prana and Vyana vayu.[16] Furthermore, Hridaya is Sthana of Sadhak pitta, [17] Avalambak kapha[18] and Oja. [19] Prana vayu accounts for dilatation of the chamber, valves, generate and carry cardiac impulse (Praspond) and diastole of the cardiac cycle. In addition to this, it is related with an acceptance of the Rasa Rakta complex in the heart (Aadaan). The vitiation of Prana vayu results in dilated cardiopathies or conduction defects. According to Aacharya Sharangdhar, Prana vayu brings Amberpiyush means oxygen inside the body by every inspiration and Udaana vayu gives Bala (energy) to cardiac muscles.

Udaana vayu is accountable for the force required to push the Rasa Rakta complex along the Aorta (Mahadhamane), in combination with Vyan (visarga). It is also responsible for the contraction of chambers, systoles and closure of the valves. The vitiation of Udaana vayu leads to hypertrophy of ventricles.

The Vata system mainly Vyana vayu controls its rhythmicity as well as contraction and relaxation which continues lifelong in a cyclic manner.[20] The concurrent rise in heart rate along with increased body activity occurs owing to the action of Vyana.
vayu which represents its entire nervous control of circulation.\[21\,22\] Vyana vayu is the resultant of the Prana and Udana activity in the heart and it is more powerful than parent Vata types. Vyana vayu can travel in three directions i.e., Upwards Archis (heart to head and back), horizontally (portal circulation) and downwards (peripheral circulation). It is responsible for the circulation of Rasa Rakta complex from the heart to the body along various channels. It accounts for all the voluntary actions.

Samaana vayu has indirect influence on the heart by reaching the first nutritive fluid i.e. Rasa dhatu from digestive process in the gut to the heart.

Sadhaka pitta resides in the heart, derives its nourishment from the Pachakapitta and it is responsible for fulfilling the desires of the mind \[23\]. It accounts for the mental faculties like intellect/ Buddhi, Medha, Ahmkaara (ego), Shourya (courage, bravery), Bhaya (fear), Krodda (anger, rage), Harsha (excitation, cheerfulness) and Moha (delusion, fainting).\[24\,25\] For that reason for in some stages of Hridroga mental signs and symptoms are observed. Disorders of Sadhaka pitta result in weak action of Hridaya leading to different cardiac disorders owing to defects in conduction system of the heart (Hridbadha) and ultimately heart failure (Hridroga). \[25\]

Panchaka Pitta is located in the Pachyamanashaya (small intestine); its main function is digestion and production of Aahar rasa. It also provides nourishment and strength of other Pitta types spread all over the body.

Avalambaka Kapha is situated in the heart itself and it accounts for smooth functioning of it by maintaining its nourishment level, supporting lubrication provided to Hridaya by the pericardial fluid and synovial fluid to the thoracic joints (Trikpradesha), preventing friction between two cells as well as between Hridaya and other organ in the Kostha (mediastinum) and the replenishing fluid to the fluid systems of the body. \[26\] To perform this function, it receives the essence of Aaharrasa (Anna veerya) and its own potency. Pericardial effusion, pleural effusion and pulmonary oedema also result from disorders of Avalambakakapha. \[26\]

It is the origin of Pranavaha srotas (channels or passages of life/air/respiration) and Rasavaha srotas (channels carrying Rasa-nutrient tissue)\[27\,28\]. The Aahar Rasa is converted into Rasa Dhatu by Rasavaha srotas which provides nourishment to all other body constituents. Thus Rasa Dhatu is the first tissue developing from the nutritive fluid Aahar Rasa \[29\]. The qualities of Rasa dhatu like Drava (liquidity), Snigdha (unctuousness), Manda (dullness) help it to please (Preenanam) the body, provides nutrition (Tushhti), conserve (Dharana) the body, and nourish Rakta dhatu. \[30\,31\]

Rasa Rakta complex is essential for continuation of life. Hridaya evolves from clear part of Rakta and Kapha. Rakta dhatu is responsible for Jeevana karma, sustaining the life process by supplying Prana to all over the body constituents. It circulates along with Rasa all over the body with the help of Vyana vayu. It provides immunity, complexion, satisfaction and longevity. Hence proper protection of Rakta dhatu is essential to safeguard life\[32\,33\,34\]. Since the fluid circulating in the Dhama and Siras is a composite whole and a complex flowing tissue, the differentiation between the circulating Rasa and Rakta cannot be made.

The chordae tendinae (made of which fibrous tissue i.e. Snayu), valves, vessels, ligament, tendons and pericardium evolve from Rakta and Meda.

Shukra dhatu is not only the reproductive tissue but also it has rejuvenative function as Shukrakunda kala spread all over the internal environment encompassing all the body constituents including heart.

The depletion in Purish (stool) causes reversal of Vayu which leads to pain in cardiac region.

The Process of Circulation

Aacharya Bhela described the process of circulation for the first time. According to him the blood [Rasa Rakta complex] is first ejected out of the heart, it is then distributed to all parts of the body, and after that, it returns back to the heart through the blood vessels recognized as ‘Sirah’. \[35\] Any derangement in these (either structure or function) is responsible for hridroga. From the Aahararasa, the body fluids carrying nutrients for all Dhatus i.e., the first Dhatu (Rasa) is derived. It passes from intestines into blood vessels and then Samanvaya brings Rasa to Hridaya from where it is pumped through its main blood vessels by the action of Vyanvaya into millions of capillaries. The Rasa penetrates all the tissues and cells of the body from capillaries. The fluid from the tissues is brought back to the Hridaya by capillaries and veins. \[41\]

Hridaya and Srotas \[37\]

Srotas is a space within internal environment capable of trans-membranous movement of various body constituents across them like accepting the nutrient fluid processing it to yield various products and disposal of the waste. Heart is the only organ that has characteristic feature of being Srotomoola of two equally significant Srotasas i.e., Pranvaha and Rasavaha Srotasas.
Circulation of Oja

After metabolism of ingested food by the action of various Agnis, the Shukra dhatu emerges and the residual matter along with the pure part of Dhatura metabolism together is termed as Oja. It is the essence of food in addition to metabolism on which strength (Bala) depends. It protects life against various diseases, decay and degeneration and supplies energy to different tissues. Para Oja is generated at the time of fertilization and looks after the fetal growth from conception till the beginning of eight month of intrauterine life. From then the Apara Oja is generated and takes over the function of sustaining life. Both the type of Oja resides in the Hridaya. The former i.e. Ashtabindwatmaka oja is in extremely small quantity i.e. eight drops while the later i.e. Shilaishmika oja, is in the quantity of half anjali. The activities of Hridaya in the Garbha (foetus) begin when the Oja which is nourishing the Garbha enters Hridaya which is being formed in Garbha. Charaka says: "The Dashamahamulak dhamanis are the channels of transport of Ojas to entire body. They are known as Dhamanayah as, they pulsat. They are called as Srotamsi, for the reason that, they permit the exudation (filtration, diffusion, permeation). They are also named as Sira since; they maintain a steady (and continuous) flow of Rasa-rakta." Gangadhar interprets the word Mahaphala, the synonym of Hridaya as 'that which fruits Mahata (importance)'. Since Oja is seated in heart, it is named as Mahaphala. Yogendranath states that Hridaya is termed as Mahaphala since its function of carrying Oja is of huge importance. 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. Hence life, vitality, consciousness, functioning of sense organs, mind and intellect and indirectly happiness and sorrow depend on the proper functioning of the heart.

Charaka mentions the Hridaya as the Chetanaadhishthana Avayava whereas Sushruta and Sharangadhara state it as the Chetana Sthana. It is the site of origin of cardiac impulse, owing to which it harbors the Aatmikgunas like Dhnyan, Vidnyas, Icchaa, Dvesha, Sukha, Dukkha, Prayatna body complex; it expresses various desires which are gratified by the mind-body apparatus. The automatic and self-controlled pulsations of Hridaya denote the perception of Chetana. And hence Hridaya Marma if injured or disordered than it leads to stopping of the chain of Chetana (Chetananiuritti Ayu), resulting in death. The heart harbors the Manas (Satva-Rajas-Tamas); the three attributes. Satva signifies piousness, purity, rationality, devotion to knowledge acquisition and dissemination etc. Rajas signifies initiative, enthusiasm, proficiency at picking up languages, spontaneity of emotions etc. while Tamas signifies lethargy, ignorance, indulgence in basal instincts like food, sex and sleep and shabby behavior. These attributes are found in the manas, the representative of the primordial Prakruti which are sequentially present in the products of the evolutionary process at the beginning of every life process and Rasa dhatu is capable of bringing about conception by providing the internal environment which is conductive for it, hence any affliction of the Rasa is reflected on the mental plane and vice versa. Aahar rasa is capable of generating all the seven Dhatus. The clear channels facilitate Dhatu Poshana (Tissue nourishment) in addition to production of Ojas (a factor which increase immunity). Failure of Agni (Hypofunctioning/Mandagni, hyperfunctioning/ Teekshnagni; erratic functioning/ Vishmagni) give rise to toxic transient metabolite called Aama which shows a special ability to cause occlusion of various spaces and channels in the internal environment. Because of presence of Aama, the Dhatu (tissue) metabolism suffers and results in malnutrition and a battery of diseases; Hridroga being one of them. The normal functioning of heart depends upon equilibrium of the Doshas present in the heart. Vitiation of any of them results in causation of heart diseases. Any of the eight basic elements viz. Rasa, Rakta, Mansa dhatu, Oja, Pranavayu, Vyana-vayu, Sadhaka pitta and Avalambakakapha when affected, can disturb the function of the Hridaya and cause Hridroga. The functioning of heart is a complex phenomenon. The synchronization among all these factors is important for sustenance of life process.

Figure: Factors Making Hridaya Vital

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DISCUSSION

The word *Hriday* consists of three syllables, i.e. hri+da+y(a)=Hriday.
1. HRU for Harati i.e., to receive from or to abduct,
2. DA for Dadati i.e., to give or to donate, and
3. YA for Yagati i.e., control of these above two functions i.e. receiving and donating (Yama).

Thus *Hridaya* denotes an organ which controls the passage of *Prana* by collecting, distributing in a rhythm. This definition indicates that *Hridaya* is the heart and *Hridaya* is the brain too. Therefore *Hridaya* can be as heart for taking and giving impure and pure blood (*Urastha hridaya*) and as brain by its functioning of knowledge, memory, intellect etc. (*Shirastha hridaya*).

The shape of *Hridaya* is like lotus whose apex or mouth is directed downwards. The both organs i.e., Heart with aorta and brain with spinal cord have resemblance with lotus with long slender stem as mentioned by Acharya Sushruta. Both of them i.e., heart and brain has downward direction; spinal cord and descending aorta appears like the stem or stalk of lotus.

According to Ayurvedic classic, *Hridaya* is the place of origin of two equally vital *Srotasas* i.e. *Pranavaha srotas*. The *Aahar Rasa* is converted to *Rasa Dhatu* which provides nourishment to all other body constituents. This work is performed by *Rasavaha srotas*. An uninterrupted supply of the *Amberapeeyush* (oxygen) through breathing is obtained by *Rasa Pranavaha srotas*. *Rasa dhatu* is the first tissue produced out of the nutritive fluid *Aahar Rasa*. *Rasa and Rakta* circulates together all over the body by *Hridaya* with the help of *Vyanavayu* and *Rakta* is accountable for *Jeevan Karma*, sustaining the life processes by providing *Pran* to the entire body constituents. *Rasa-rakta* complex is necessary for the nourishment and persistence of life. The *Rasa* i.e. fluids and nutrients, *Rakta* and *Oja* i.e. vital fluids are pumped by *Hridaya* to all the tissues and organs of the body. Therefore the proper functioning of the heart is responsible for life, vigor, consciousness, performance of sense organs, mind and intellect and indirectly happiness and sorrow depend on it. The human heart provides tissues with vital nutrients, and facilitates waste excretion. As a result, cardiac dysfunction leads to overwhelming physiologic consequences. Disruption of any element of the heart i.e. myocardium, valves, conduction system, and coronary vasculature, can adversely influence pumping efficiency consequently results in morbidity and mortality. [45]

Optimum and efficient circulation of blood throughout the body ensures proper nutrition, excretion, gaseous exchange, thermoregulation and haemostasis, digestion and metabolism, immunity and life in the body. Acharya Sushruta mentions that *Hridaya* is place for *Chetna tatva* (consciousness). Thus heart is responsible flow of life to all over body. This fairly explains the importance of this in our body and its vulnerability to any kind of disturbances in the body and reason of cardiovascular disease being leading cause of death.

*Pranavaha srotas* is accountable for uninterrupted supply of the *Amberapeeyusha*, through breathing. During inhalation, *Pranavayu* causes dilation of chambers, various valves opening. It is able to expand because of its indivisible allegiance with *Rakta* and its *Ushna* attribute. The lungs up to alveoli expand by *Prana vayu* and the inhalation is done. Likewise blood is accepted in right atria (*Alinda*) of heart and is pushed in the right verticals (*Nilaya*) and from there it discharges in the great vessel like pulmonary artery. This blood interacts freely with the treated air (*vishupadaamrita*) and the result is *Phenapradurbhav* in the lungs. Thus, the blood after interaction and exchange returns to the heart for circulation. Thus right verticle half of heart is the *Pranavaha srotas*. Moreover, *Prana Vayu* is responsible for creating the cardiac impulse (*Praspana*) which travels mostly on the right side of the heart with only a branch to the left. The clinical picture of right sided failure resembles that of the *Pranavaha srotas*. [37]

The first nutrient fluid (*Rasa*) resulting from various digestive processes in the alimentary canal oozes out in the vessels (*Rasayanees*) and from there it is carried to heart for circulation. The blood after interaction and the gaseous exchange in the lungs returns to the heart. This combination is sent out of the heart by the action of *Vyana vayu* from the aorta of the left ventricle to nourish the whole body. There for left verticle half of heart is the *Rasavaha Srotomoola*. Furthermore, the left sided failure resembles affliction of the *Rasavaha srotas*. [37]

The heart, the four chambered pumping organ of the circulatory system is enclosed within the pericardium along with the great vessels and is located in middle mediastinum, the heart supplies nutrition and provides life by circulation of *Rasa* (body fluids) and *Rakta* (blood) complex. Myocardium is derived from *Mansa dhatu* (muscular tissue) and pericardium *Meda dhatu* is derived from (fatty and connective tissue) respectively. One or all the three *Doshas* can affect each of these layers. For normal functioning of heart depends upon equilibrium of these *Doshas* present in the heart. The vitiation of any of the *Doshas* results in causation of cardiac diseases.
Hridaya - Chetana Sthana

According to Acharya Charak Prana and Oja (Para Oja) rest in Hridaya (heart), Acharya Sushrut has mentioned that heart is the place for Chetna tattva. (Hridayam Chetana Sthanam) which means the seat of consciousness is in the heart. Life flows to all over body by Heart and Sharir dharan (sustaining the body) depend on it.

Furthermore it is the seat for mind or Mana. [46] According to Chakrapani Chaitanyakasangraha (Charak Su. 30/7) means that consciousness is concentrated in heart by controlling the mind. Heart is the place of origin of cardiac impulse, on account of which it harbors the Aatmikgunas like Dhnyan, Vidnyas, Icchaa, Dvesha, Sukha, Dukkha, Prayatna. Balhik Bhishaka Kankayana explained that as the Hridaya (heart) being receptacle of Chetana tattva so it is differentiated first in fetal development. Dhanvantari considered that all organs like Hridaya (heart) are formed simultaneously with Bhavas like Oja, Mana, Aatma and Buddhi. The Hridaya (heart) is indispensable for all the normal mental and physical activities because the entire sense perception (representing the action of Vayu) depends on the heart.

According to Acharya Charak thought, decision, discussion, grasping, determination and anything perceived by the mind; like happiness, sorrow, desire, aversion and other thinkable things are the objects of mana or mind. On the basis of ancient and modern science it can be stated that these are the subjects of brain. After the brain death, the heart can be transplanted, hence it can be stated that the Mana is located in the brain, only the various desires or virtues (Bhavas) revealed by Mana are expressed by Hridaya. One of the etiological factors of vitiation of Rasavaha srotasa is over-anxiety (Charak samhita vimansthan chapter 5).

According to Neurocardiology, heart is a sensory organ and a sophisticated centre for receiving and processing information which has highly complex system with its own functional brain. Various experiments have showed that the signals continuously sent by heart to the brain influence the function of higher brain centers involved in perception, cognition, and emotional processing. More information moves from heart to brain in three ways i.e. neurologically (through transmission of nerve impulses), biochemically (through hormones and neurotransmitters) and biophysically (through pressure waves). Besides, rising scientific facts indicate that the heart may communicate with the brain and body in a fourth way i.e. energetically (through electromagnetic field interactions). Thus heart has a dynamic relationship with brain. So it performs and regulates the functions of both circulatory as well as nervous system.

CONCLUSION

Ayurveda described both brain and heart i.e. under one dome i.e., Hridaya. The Urastha hridaya considered in Ayurveda as described in Samhitas was hollow organ (Koṣtha), having a shape of lotus and formed by two peshis, and three Mandalas sandhis, and linked with ten Maha dhamanies i.e. pulsating vessels which provide blood, oxygen, nutrition, and consequently immunity to the whole body. Considering this fact Urastha hridaya is having resemblance with heart considered in modern anatomy anatomically, physiologically and functionally.

REFERENCES

5. Agnivesha. Dwivedi Lakshmidhar, Dwivedi BK, Goswami Pradip Kumar, Editors. Charaka Samhita, Vol II. Chowkhamba Krishnadas Academy, Varanasi. Sarira Sthan Ch. 6
Samhita. Vol I. Chowkhamba Krishnadas Academy, Varanasi. Sutra Sthan Ch. 25 Ver.5
35. Maharshi Bhela, Bhela samhitha, Hindi commentary by Sri Abhay Katayan, Chowkamba Surbharati Prakashan varanasi, sutrathana, chapter 20, shloka, 3: 101
37. Vaidya Vilas Nanal Some Cardiotonic Herbs, Nanal Softwares, 606, Sadashiv Peth, Kunte Chowk, Pune 64-65
41. Bhaskar Govind Ghanekar, Sushrut Samhita (Sharirsthana), Chapter 6, Citation no. 33 Reprint, Nov.2008, Meharchand Lachhmandas Publications, Page no. 126
42. Bhaskar Govind Ghanekar, Sushrut Samhita (Sharirsthana), Chapter 6, Citationno. 34 Reprint, Nov. 2008, Meharchand Lachhmandas Publications, Page no. 126