



UNIQUE JOURNAL OF AYURVEDIC AND HERBAL MEDICINES

Available online: www.ujconline.net

Research Article

EXPERIMENTAL CADAVERIC STUDY TO DETERMINE 'SIRA' AS DESCRIBED IN SUSHRUT SAMHITA

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Received 28-12-2014; Revised 24-01-2015; Accepted 22-02-2015

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ABSTRACT

In the Context of *Ayurved Acharya Shusrut* explains the *Rachna Sharir* (Anatomy) of human being and he described many structures which have both structural as well as clinical importance but due to difference of era Ayurvedic scholars are unable to identified, understand and explain of that anatomical structures. 'Sira' is one of that structures which has its structural and clinical significance. So to understand the concept of Sira which is explained by Acharya Sushrut; this study was undertaken. To understand the concept of sira literary study and experimental cadaveric study was carried out. The literary study was carried out as done by the previous research worker in the field of applied anatomy of Ayurveda. And the experimental cadaveric study is carried out as per the guidelines described in *Shusrut samhita*.

It is not possible to understand the concept of Sira or any other structure which are explained in *Sushrut samhita*, by the method of preservation according to modern science through formalin because formalin change the property of structures. And the structures are not appeared in such a way as appeared during the time when *Acharya Sushrut* preserves the cadaver.

From the review of *Ayurvedic* Literature, Modern literature, and cadaveric study conclusion are drawn that *Arun varna sira* (*Vata-vaha sira*) means-Nerves of Body, *Neel varna sira* (*Pitta-vaha sira*) means-Veins of Body, *Gour varna sira* (*Kapha-vaha sira*) means-Lymph vessels of Body, *Rohini sira* (*Rakta-vaha sira*) means-Arteries of Body & *Mool sira* are the neurovascular bundle.

Keywords: *Shusrut Samhita*, applied anatomy of *Ayurveda*, *Arun*, *Neel*, *Gour* & *Rohini- Sira*

INTRODUCTION

Ayurveda being an ancient system of medical science explain *Rachna sharir* (Anatomy) of different structures. In that, *Sushrut samhita* is best to explain Anatomical structures. 'Sira' described in the *Sushrut Samhita* as an important structure as well as a structure having clinical significance. The important descriptions of 'Sira' are explained by Acharya Shusrut in *Sutrasthan*, *Nidansthan*, *Sharirsthan*, *Chikitsasthan*, of *Sushrut Samhita*.

It is needful to explore the above mentioned available description of 'Sira' for the purpose of understanding the concept of 'Sira'. The Research work is carried out by thoroughly studied of entire *Sushrut samhita* to find out the answers to the scientific queries and by the experimental cadaveric study to Determination of 'Sira' and 'Mool-Sira'.

The Research work is carried out to find out scientific answers regarding and related to the *Sira*, on the basis of the

observations obtained from the literary study and experimental cadaveric study. The observations are correlated and interpreted to find out scientific answers regarding and related to scientific queries of *Sira*. The scientific statements regarding and related to *Sira* in respect of its structural and clinical aspects are derived from the description studied during the research work. The observations of the study are correlated and interpreted to derive the scientific statements on *Sira*.

MATERIALS AND METHODOLOGY

The study was carried out in two phase.

Phase 1:

Literature Study: Study of the *Sushrut Samhita* was carried out according to the methodology developed by the previous research worker in the field of *Rachna Sharir* (Anatomy)¹. Thorough study of the *Sushrut samhita* was carried out & baseline thoughts were developed on the basis of this detailed study.

1. In the study to achieve scientific information, references from any other samhitas other than Sushrut–Samhita are not considered, for scientific extraction of meaning because such reference may lead to misdirection as the conceptual & terminological difference between Sushrut–Samhita, other Samhita & their Samhitakars.

2. Considering possibility of mistakes in the obtained script which may lead to wrong interpretation. Only correct script is studied & considered.

3. All meaning of a word which is carrying many meaning are considered, & selected appropriate meaning for correct interpretation

4. The typical methodology of description of Acharya & sequence of the description considered.

5. Any commentators, commentary has not been considered because there is doubt about scientific authenticity of commentary

The reasons of doubt are as follows:-

a) There is gross difference between the era of Sushrut & its commentator's era.

b) Competency of commentator over Sushrut acharya as Vaidya.

c) Unclearity regarding history of commentators. Medical knowledge, as it is unclear that whether the commentatators ae Vaidyas or only Sanskrit proficiencie.

6. Meaning of shlokas is not drawn independently. Every shloka was considered with all its references & with the Samhita.

7. In brief, scientific meaning is drawn by trying to enter into role of 'Acharya Sushrut', in the Sharira & Shalya pradhan view of Acharya Sushrut for the virtual extraction of the hidden scientific meaning & virtual thinking to interpret the Shlokas².

Phase 2:

Experimental cadaveric study: Experimental Cadaveric study was carried out according to *Mrut-sanshodhan Vidhi* as described in Sushrut samhita³.

The entire cadaveric study is carried out with co-research workers in the following manner.

Step 1.

On Day 1 of the experiment Unembalmed female cadaver was selected for obtaining body part for the purpose of the cadaveric study.

Step 2.

On Day 2 of the experiment Unembalmed body parts i.e. right upper limb was amputated from medial border of scapula and from lateral half of clavicle. Then arteries and veins of the amputated part were ligated by thread.

Step 3.

On Day 3 of the experiment the body parts was covered by leaves of *Shan* (*Crotalaria juncea* Linn.) and tied by thread. Then the body parts keep in running water in the appropriate container in the dissection hall. Precaution for the fully emersion of the body parts were taken throughout the duration of study. Out flow and inflow of water in container is maintained and the temperature of water was maintained from 2° to 10° centigrade. The body parts are kept for seven days in this manner. After seven days i.e. on the 8th day morning the wet macerated body parts were taken for dissection.

Step 4.

On day 8th to day 13th dissection of macerated body part is done layer by layer.

The observations were noted by photographs of body parts.

OBSERVATION AND RESULTS OF LITERATURE STUDY

Determination of Sira:-

Development of Sira described in the *Garbhav-kranti Adhyay*. It is described that *Pitruja* (Paternal), *Matruja*(Maternal), *Rasaja*(Nutritional), *Atmaja*(Spritual), *Satvaja* (quality of purity or goodness or magnanimity) and *Satmyaja* (habitual or united with the soul) *bhav* are the factors need for the development of various *Avayavas* (organ) of the *Garbha* (embryo). The *avayavas* *Kesh*(hair), *Shamshru*, *Lom*, *Asthi*(Bones), *Nakh* (Nails), *Dant* (Teeth), '*Sira*', *Snayu*, *Dhamani*, *Shukra*, are develop from *Pitruja* (Paternal) *bhava*⁴. In embryonical development, '*Sira*' is developed by *mradu paka* of *Meda* & *Sneha* & '*Snayu*' is develop by the *khara paka* of *Meda* and *Sneha*⁵.

Acharya Shusrut described 4 type of 'Sira' i.e.

1. *Aruna* (*Vata-vaha sira*) are filled with *Vayu* and are of *Arun varna* i.e Reddish colour as appeared during sunrise.
2. *Neela* (*Pitta-vaha sira*) are filled with *Pitta*, *Ushna*(hot) in nature and blue in colour.
3. *Gouri* (*Kapha-vaha sira*) are filled with *Kapha*, *Shit*(cold) in nature & white in colour.
4. *Rohini* (*Rakta-vaha sira*) are filled with *Rakta*, moderately (not too much) hot & cold in nature & red in colour⁶.

The *Mool* of all '*Siras*' are Navel, from navel the branches (*Pratan*) of *Siras* are dispersed all in body parts. Navel is site of *Prana*. Navel is surrounded by *Siras* in the same way as the nave of the wheel is surrounded by spokes, the description of shloka can be correlate with *garbhavasta* (embryological condition)⁷.

It is found described that there are 700 'Sira' which is responsible for nourishment of body. The nourishment process is happened like the garden in nourished by water through irrigating channels. The contraction and relaxation of Sira is responsible for this process⁸.

Functions of Sira as follows:

The main function of 'Sira' is that it is responsible for circulation of *Vata*, *Pitta*, *Kapha* and *Rakta*. And these *Dosh* circulate in *Sira* and perform different function so through concept of *Ashray-Ashrayi bhav* function of *Dosh* are the Function of Sira.

All (voluntary and involuntary) neurological functions are carried out by natural or unaltered *Vayu* during circulation in its own '*Siras*'. *Praspanadan* (Locomotary function, contraction, relaxation etc), *Udvahan* (breathing, special sensory function etc), *Puran*, *Vivek* (discretion), *Dharan* (maintaining) are the function of *Vayu*. When vitiated *Vayu* occupies its own *Siras*, it causes various *Vataj* disorders⁹.

Lusture, relish in food, stimulation of *agni* (increase of appetite), and healthiness are the functions carried out by the natural or unaltered *Pitta* during circulation in its own *sira*. *Rag*, *Pakti*, *Tej*, *Medha*, *Ushma* are the normal functions of

Pitta. When vitiated *Pitta* occupies its own *Siras*, it causes various *Pittaj* disorders¹⁰.

Oleation in body parts, steadyfastness in joints, strengthness are the functions of natural or unaltered *Kapha* doing during circulation in its own *Siras*. *Sandhi sansleshan*, *snehan*, *Ropan*(healing), *strengthness* and *stedyness* are the function of natural *Kapha*. When vitiated *Kapha* occupies its own *Siras* produces various disorders of *Kapha*¹¹.

Dhatu-poshan (replenishes *Dhatus*), *Varna* (complexion), *Sparsh dnyana* (sensation of touch), steadiness are the function of natural *Rakta*(Blood) doing during circulation in its own *sira*. When vitiated *Rakta* occupies its own *siras* produces various disorders of *Rakta*¹².

Determination of Mool Sira:

Siras are 700 in no. in that 40 are *Mool Sira*. (10 *Mool Sira* of Each *dosh*). Each *Mool sira* is divided into 175 branches (*Pratan*). As described below^{13,14}

No.	Dosh	Moolsira	Total Branches
1	Vatavaha Sira	10	175
2	Pittavaha Sira	10	175
3	Kaphavaha Sira	10	175
4	Raktavaha Sira	10	175
	Total	40	700 Siras

Distribution Of Shakhagat Koshtagata & Urdhvajatrugata Sira:

No.	Body parts	Vatavaha	Pittavaha	Kaphavaha	Raktavaha	Total
1	Shakha-gat (In limbs)	25	25	25	25	100*4=400
2	Koshta-gat (In Trunk)	34	34	34	34	136
3	Urdhva-Jatru-gat (above clavical region)	41	41	41	41	164
						Total=700

Distribution Of Koshta-Gat Sira:

No.	Body parts	Vatavaha	Pittavaha	Kaphavaha	Raktavaha	Total
1	Shroni (Pelvic region)	8	8	8	8	32
2	Parshva(Side of trunk)	4	4	4	4	16
3	Prushtha(Back)	6	6	6	6	24
4	Udar (Abdomen)	6	6	6	6	24
5	Vaksh (Chest)	10	10	10	10	40
						Total=136

Distribution Of Urdhva-Jatru-Gat Sira:

No.	Body parts	Vatavaha	Pittavaha	Kaphavaha	Raktavaha	Total
1	Griva (Neck region)	14	14	14	14	56
2	Karna (Ear)	4	2	2	2	10
3	Jivha (Tongue region)	9	9	9	9	36
4	Nasika (Nasal region)	6	6	6	6	24
5	Netra (eye)	8	10	10	10	38
		Total=41				Total=164

The *Mool Sira* described by *Achary Sushrut* are structurally determined as follows-

No.	Mool sira	Structural determination of mool sira	Vatavaha	Pittavaha	Kaphavaha	Raktavaha	Total
1	Right upper limb mool sira	Neurovascular bundle at the inlet of right Axilla.	1	1	1	1	4
2	Left upper limb mool sira	Neurovascular bundle at the inlet of left Axilla.	1	1	1	1	4
3	Right lower limb mool sira	Neurovascular bundle at the base of right femoral triangle.	1	1	1	1	4
4	Left lower limb mool sira	Neurovascular bundle at the base of left femoral triangle.	1	1	1	1	4
5	Urdhva jatru Right side	Neurovascular bundle at the base of right side of neck.	1	1	1	1	4
6	Urdhva jatru left side	Neurovascular bundle at the base of left side of neck.	1	1	1	1	4
7	Koshtasta urdhvaga	Neurovascular bundle at the inlet of thorax.	1	1	1	1	4
8	Koshtasta	Neurovascular bundle at the inlet	1	1	1	1	4

	<i>Adhoga</i>	of abdomen					
9	<i>Koshtasta Tiryaka</i>	Neurovascular bundle at the lateral side of right half & left half of thorax & abdomen.	1	1	1	1	4
10	<i>Nabhi</i>	Neurovascular bundle in umbilicus.	1	1	1	1	4
						Total = 40	

OBSERVATION AND RESULTS OF EXPERIMENTAL CADAVERIC STUDY

➤ On 12 day of experimental cadaveric study, twacha was dissected and removed. And further dissection was carried out.

➤ Than dissect the Axilla and observed 4 to 5 “Arun varna” (i.e. reddish coloured as appeared during sunrise), thick, long, solid, cord like structure identified as nerves of Brachial plexus. (*Vat-vaha sira*)



➤ Than further dissect the medial side of axilla and observe a white colour, hollow, cord like structure. Identified as a *Gauri (kapha vaha sira)*.



➤ Than further dissect the medial side of arm and observe another red colour, thick, hollow cord like structure identified as Brachial artery. Rohini (*Rakta vaha sira*).



➤ Than further dissect the forearm and observe another *Arun varna*, cord like structure we identified as median nerve.



➤ Than further dissect the cubital fossa and observed Neel varna, hollow, cord like structure identified as cephalic vein & basalic vein & median cubital vein. (*Neel varna sira*).



DISCUSSION

The unsolved mystery of the description *Sapt-Sira-Shatani* was the challenge undertaken at the starting point of the research work. The ambiguity regarding the meaning and structural determination of *Vat-vaha*, *Pitta-vaha*, *Kapha-vaha* and *Rakta-vaha Sira* was another concept which was needed to be resolved on the basis of literary study and cadaveric study.

The observations obtained and the data collected by means of various stages of the study i.e. (phase 1 and phase 2 of study) were needed to be correlated and interpreted on the basis of the baseline concept and thought described by the *Acharya Sushrut*.

➤ *Vata-vaha sira* are *Arun varna sira*. And observation during cadaveric study is that, nerves of brachial plexus, median nerve, radial nerve¹⁵ are found *Arun varna*, thick, cord like structure.

➤ *Pitta-vaha sira* are *Neel varna sira* (blue in colour) and observation during cadaveric study is that, structure identified as basalic vein and cephalic vein¹⁶ are blue in colour and another property of *pitta vaha sira* i.e. *Ushna*(hot) in nature are perception of *Acharya Sushrut* for live person. .

➤ *Kapha-vaha sira* are white in colour and observation during cadaveric study is that structure was found white, thick, hollow, cord like, but it was not possible to identified the structure because of limitations of experimental cadaveric study.

➤ *Rakta-vaha sira* are red in colour and filled with *Rakta* and observation during cadaveric study is that structure identified as brachial artery was thick, hollow, and red colour.

➤ Definite structure information described in the respect of *Sira prakara* i.e. *Aruna (Vat-vaha Sira)*, *Neela (Pitta-vaha Sira)* *Gauri (Kapha-vaha sira)*, *Rohini (Rakta vaha sira)*. The *Sira* means definite *Pratan* like structure.

During the study above mentioned clarity is observed by means of data obtained. The only queries remain regarding the

exact meaning of/ The exact expectation of the description of *Mool sira*.

After the thoroughly study of Sushrut samhita it is observed that the *mool sira* are the bunch of *Aruna*, *Neela*, *Gauri* and *Rohini sira*. Which clear the concept of *Mool sira* as Neurovascular bundle.

CONCLUSION

Sira is the independent structure. The term *Sira* described in the Sushrut samhita carries two different meanings.

A) The term *sira* itself i.e. *mool sira*.

B) *Pratana of Sira* i.e. branches of *mool sira*

The term described as *Sira sapta Shatani* means *Saptshata* (700) *pratana* i.e. branches of *mool Sira*.

- The structure described by means of the term *Aruna (Vata-vaha sira)* means *pratana* (branches) of the nerve plexus in case of the Limbs. And in Head, neck, abdomen and thorax the *Aruna (Vata-vaha sira)* means nerves or branches of the nerves.
- The structure described by means of the term *Neela (Pitta-vaha sira)* means *pratana* (branches) of veins in limbs, abdomen, thorax, head and neck.
- The structure described by means of the term *Gouri (Kapha-vaha sira)* means *pratana* (branches) of lymphatic channels in limbs, abdomen, thorax, head and neck.
- The structure described by means of the term *Rohini (Rakta-vaha sira)* means *pratana* (branches) of Arteries in limbs, abdomen, thorax, head and neck.

From the review of Ayurvedic Literature, Modern literature, and cadaveric study following conclusion are drawn-

1. *Arun varna sira (Vata-vaha sira)* means-Nerves of Body.
2. *Neel varna sira (Pitta-vaha sira)* means-Veins of Body.
3. *Gour varna sira (Kapha-vaha sira)* means-Lymph vessels of Body.
4. *Rohini sira (Rakta-vaha sira)* means-Arteries of Body.
5. *Mool sira* are the neurovascular bundle.

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Source of support: Nil, Conflict of interest: None Declared