A STUDY OF SUSHRUTOKTA SIRAVEDHA IN PADADAHA WITH SPECIAL REFERENCE TO TWO FINGERS ABOVE ADHOSHAKHAGATA KSHIPRA MARMA

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BY

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M.D. (Ayu.) Ph.D.

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CERTIFICATE OF THE SUPERVISOR

It is certified that work entitled **"A study of Sushrutokta Sira vedha in Padadaha with special reference to two fingers above adhoshakhagata Kshipra marma."** is an original research work done by **Dr. Smita Rajanna Gotipamul** Under my supervision for the degree of Doctor of Philosophy in **Ayurved- Rachana Sharir** to be awarded by Tilak Maharashtra Vidyapeeth, Pune. To best of my knowledge this thesis

- embodies the work of candidate herself
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UNDERTAKING

I Vd. Smita Rajanna Gotipamul is the Ph. D Scholar of the Tilak Maharashtra Vidyapeeth in Rachana Sharir subject. Thesis entitled **A study of Sushrutokta Sira Vedha in Padadaha with special reference to two fingers above adhoshakhagata Kshipra marma** under the supervision of Dr. Atul Mankar, Solemnly affirm that the thesis submitted by me is my own work. I have not copied it from any source. I have gone through extensive review of literature of the related published / unpublished research works and the use of such references made has been acknowledged in my thesis. The title and the content of research is original. I understand that, in case of any complaint especially plagiarism, regarding my Ph.D. research from any party, I have to go through the enquiry procedure as decided by the Vidyapeeth at any point of time. I understand that, if my Ph.D. thesis (or part of it) is found duplicate at any point of time, my research degree will be withdrawn and in such circumstances, I will be solely responsible and liable for any consequences arises thereby. I will not hold the TMV, Pune responsible and liable in any case.

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INTRODUCTION

Ayurveda is a practical science of life with its principles universally applicable to each individual for daily existence. Ayurveda speaks of every elements and facts of human life offering guidance that have been tested and refined over many centuries to all those who speak greater harmony, peace and longevity. Ayurveda does not treat the human body as a machine which can be analyzed in the terms of its parts and various mechanisms can be understood at the biological or molecular level.

Sushruta Samhita is one of the two most ancient, encyclopedic and authoritative, classical books of Indian medicine.

शारीरे सुश्रुतः श्रेष्ठः |

Acharya Sushruta has taken great pains in supplying all the necessary information required by the student of anatomy as it was studied in ancient India and there are strong grounds for believing that the surgeons and anatomists of this country were more advanced in their knowledge than their contemporaries in other neighboring countries, but the practice of surgery in ancient India rapidly declined since the advent of the Buddhist Cult.

Archarya Sushruta has practically explained about Sharir Rachana in ancient time, After Samhita period, dissection knowledge was depressed in India. So the terms Sira, Srotas, Dhamani came to be misunderstood and misapplied in a number of ways.

मूलात् ख्वादन्तरं देहे प्रसृतं त्वभिवाहि यत् |

स्रोतस्तदिति विज्ञेयं सिराधमनिवर्जितम् ||

सु. शा. ९/२५

Although the terms Sira, Dhamani & Srotas are often used as synonyms in common prevalence and are so interpreted in some Sanskrit lexicon (Amarakosh), yet in anatomical and other portion of ayurvedic works they usually convey special meanings. Sushrutacharya explained more clearly and disprove an old theory that the siras, the Dhamanis and the Srotas's are all the same. He establishes the point that they can be distinguished from one another because of

1. Distinct characteristics

2. Different sources of origin

3. Different functions

4. And their usage in Ayurvedic literature in different aspect

He then adds that they appear so much alike one another owing to close vicinity and similarity of functions and sometimes owing to their ambiguous use in Ayurvedic literature.

सिराव्यधश्चिकित्सार्धं शल्यतन्त्रे प्रकीर्तितः |

यथा प्रणिहितः सम्यग्वस्तिः कायचिकित्सिते ||

सु.शा. ८/३५

In Ayurveda sira vedha or bloodletting is half treatment for vataj vyadhis. It is indicated in therapeutic as well as prophylaxis. Acharya Charak, Sushruta and Vagbhat described it in various ailments. Prophylactic use in various diseases i.e. twak dosha, granthi, shopha, gridhrasi, vishwachi etc. Siravedha is one of the aims of Acharya Sushruta. Acharya Susruta has mentioned diseases that are not relieved so quickly by Snehana, swedanadi measures, in this situation; Siravyadha is an emergency management to achieve better results. Acharya Susruta further says that, this is the only therapy which helps in eliminating

all the three vitiated Doshas at a time. He further advocate that if all the five-fold purificatory procedure cannot be performed due to lack of time then, even 'Raktamokshana' can serve the purpose.

Expulsion or removal of vitiated blood from the body is known as Raktamokshana. This can be done either through the prominent superficial veins with the help of simple scalp- vein canula (Siravyadha), with the help of Leech (Jalūkavacharana), by taking multiple Incisions on a particular site (Prachana Karma), by sucking blood with the help of animal horn (Śringa) from the site where prior incision is taken or removing blood with the help of empty dried bottle gourd (Alabu).

Siravyadha has been one of the most commonly used procedures amongst various methods described in Indian Classical Surgery. The school of Susruta applied this technique therapeutically as well as prophylactically. The superficial veins are considered to be most suitable for Siravyadha.

Selection of topic-

Various diseases of foot like Pada daha, Pada harsha, Pada dari etc. are still to be explained with their important treatment told by Ayurveda. It is need of time to brush up our knowledge and compare it with modern terminologies, which will help in uplifting of both Ayurveda and modern sciences.

Some of the structural terms have no literary review and anatomical demarcations as yet. These undefined terms are to be carefully explored and clearly demarcated through thorough study and dissection procedures.

Hence, fruitful efforts should be made to bring truth in light, for which research is of utmost importance and is the only key.

प्रत्यक्षतो हि यद्दृष्टं शास्त्रदृष्टं च यद्भवेत् |

समासतस्तदुभयं भूयो ज्ञानविवर्धनम् || सु.शा. ५/६०

Whatever is practically seen and whatever is known from scripture that both combined together help in escalation of knowledge. The lacunae, which we see today in our acquaintance, are due to the incarnations of Pratyaksha and Shatra.

Importance of topic-

Though Padadaha is not a life threatening condition, it is a very painful condition. While describing Padadaha Sushruta and Vagbhata have mentioned-

पादयोः कुरूते दाहं पित्तासृक्सहितोऽनिलः |

विशेषतश्चंक्रमिते पाददाहं तमादिशेत् ||

सु.नि.१/ ८०

Vayu combined with pitta and rakta causes burning sensation in feet particularly while walking. It is known as Padadaha. In today's modern era physicians come across so many patients suffering from the disease 'Padadaha'. The incidence (10%) of Padadaha is increasing day by day in today's population due to fast life in cities. People have to travel a lot due to their job. They aggravate Vata dosha. Acharya Sushruta while mentioning 'Padadaha' narrates that especially due to Chankramana. i.e. excess walking, vata is aggravated. When this aggravated vata gets associated with pitta and rakta dhatu, the chala guna of vata later localizes this rakta and pitta in Padadaha and manifests burning sensation in feet. It may occur single foot or in both feet. The pain is pronounced while walking and it is mild when standing (or sitting). This disease is commonly found in old age, obese persons due to poor blood supply, vitamin deficiency, injury, infection etc. In Ayurveda Padadaha is explained under the heading of Vatavyadhi. There is mainly of dushti of Pitta and Rakta at pada region. So in the treatment found in Ayurved text.

तत्र पाददाह पादहर्षावबाहुकचिप्पवातशोणितवातकण्टकविचर्चिका पाददारीप्रभुतिषु

क्षिप्रमर्मण उपरिष्टाद् व्दिअंगुले व्रीहिमुखेन सिरांविध्येत् | सु.शा. ८ /२६

In Sharir adhyaya 8 acharya Sushruta mentioned the particular sira which are to be punctured in particular diseases. He explained in diseases like Padadaha, Padaharsh, Avbahuka, chippa etc. the sira vedhan should be done with vrihimukha instrument two fingers above the Kshipra marma. Above mentioned only one disease have been selected for this study for simplifying the work and make it easier and concise.

This study is aimed to verify the Sira mentioned by Acharya shusruta in Padadaha disease and the other siras which are not mentioned are compared with the blood vessels of the lower extremity as per the modern Anatomy. Although the references are available in the original Ayurvedic texts, the direct reference of site of sira vedhan in Padadaha disease in relation to its anatomical significance is not available.

This study will be helpful for physicians to understand concepts related with vedhya sira and Padadaha and thus contribute in the treatment of Padadaha.

PREVIOUS WORK DONE

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Aims and objectives

Aim

1. The main aim of the study is to see the actual effect of adhoshakhagata sira vedha two fingers above Kshipra marma in Padadaha.
2. To see the role of sira vedhan of sira which lies two angula above Kshipra marma and the sira vedhan of other adhoshakhagat sira, relieve daha in patients of Padadaha.

Objectives

1. To study the adhoshakhagata Vedhya siras conceptually as well as cadaveric.
2. To see the relationship between other adhoshakhagata Vedhya sira not mentioned by Acharya Sushruta in Padadaha.
3. To study anatomy of vein conceptually from the available modern texts.

SIRA SHARIR

ध्मानात् धमन्यः स्त्रवणात् स्त्रोतांसि सरणात् सिराः □

च . सू . ३0क्र१२

The blood vessels which possess Sarana Karma are called as Siras.
As per the Vedas, the Sira is defined as Hira channel that carries the impure blood and Dhamani carries pure blood.

सरणात् नाम अवयवांतर गमनात् □चक्रपाणि टीका

The blood vessels which are possess Sarana Karma and circulating throughout the body. By means of Sarana Karma blood vessels carrying Rasadis from one place to another place. Blood vessels possessing Sarana Karma in Mrudugati are called as Siras. Usually Sira is accepted as vein; in this present day era by transmitter category of authors even though the term Sira is denoting different meanings like artery, vessel and nerve. Concerned to this verdict few references we can quote such as –

As per Sushruta and Vagbhata, depending on the nature Sira can be classified as Vatavahini, Pittavahini, Kaphavahini & Raktavahini.

Sira Paribhasha

व्याप्नुवन्त्यभितो देहं नाभितः प्रसृताः सिराः □

प्रतानाः पदिमनीकन्दाद्विसादीनां यथा जलम् □□ सु . शा . ७क्र१८

As the branches of Padminikanda are spreading in Jala, likewise the Siras from Nabhi are spreading in body in all directions.

Prakupita Vata getting Ashraya in Amsa Sandhi and causing Shoshana of Sandhi Bandhana resulting into Amsa-shosha that existing Vata causes Sankocha of Sthanika Siras giving rise to Avabahuka, that means Sira is considered as ‘Kandara’ [Ligament].

The circulating blood in Siras causes Dhatu Poorana, Kanti, etc. So may be considered as Dhamani.

Sira Utpatti

असृज उपधातुः □ततो रक्तमसृजः कण्डराः सिराः □ सु.सू.१४ क्र २०

तदुत्पत्तिः असृजः सिराणामुत्पत्तिः □च. चि. १५क्र१७

वायुर्मेदसः स्नेहमादाय सिरोत्पत्तिं कुर्यात् □तासां पाको मृदुः □

सु. शा. ४क्र२९

According to Teekakar of Sushruta Samhita, Sira is Upadhatu of Rakta Dhatu. Sira formed from Rakta. Vayu combined with pitta creats the srotas entering into muscle tissue, they vayu and pitta divide the muscle into peshi. From the unctuous portion of medas both sira and snayu are formed. Sira arise from mrudu pak and snayu from kharapak.

यावत्यस्तु सिराः काये संभवन्ति शरीरिणाम् □

नाभ्यां सर्वा निवध्दास्ताः प्रतन्वन्ति समन्ततः □

नाभिस्याः प्राणिनां प्राणाः प्राणान्नाभिर्व्यपाश्रिता □

सिराभिरावृता नाभिश्च□ताभिरिवारकैः □ सु. शा. ७क्र४ ५

Nabhi is the place of origin for the Siras and from these they are distributed in all directions. All the Siras of the body are connected to Nabhi, and are distributed as a network throughout the body. The Pranas are located at the site of Nabhi and are associated with it. The Siras are radiating from the Nabhi like spokes from the centre of a wheel.

दशमूलसिराः हृदयप्रतिबध्दाः सर्वांगप्रत्यंगेषु ओजेनयंति □

तत्प्रतिबध्दा हि शरीरचेष्टाः □

सं. शा. ६

दशमूलसिराः हृत्स्थाः ताः सर्वाः सर्वतो वपुः □सात्मकं वहंत्योजो तन्निबध्दं हि चेष्टितम् □
स्थूलमूलाः सुसूक्ष्माग्राः पत्ररेखाप्रतानवत् □भिद्यंते तास्ततः सप्तशतान्यासांभवति तु □

अ. हृ. शा. ७

Mula Siras (Root veins) are ten, located in the Hridaya, they transport the Rasa and Ojas to the whole of body. On them, all the activities of the body depend. They are large at their roots and very small at their tips and appear like the lines of a leaf. Thus divided and become seven hundred in number. [Nabhi has been said to be the origin point of Siras. In fetus it can be seen also that number of veins are attached to Nabhi. After birth all the Siras attached to Nabhi don't function.]

Siras are important in Sandhis as well they transport the Dosha and Dhatus. All these are attached to the Nabhi further they ramify to approach various structures of the body.

Sira Swaroopa :

तत्रा□णाः वातवहाः पूर्यन्ते वायुना सिराः □
पित्तादुष्णाश्च नीलाश्च शीता गौर्यः स्थिराः कफात् □
असृग्वहास्तु रोहिण्यः सिरा नात्यष्णशीतलाः □ सु. शा. ७क्र१८

Vatavaha Siras are light red in colour, carrying Vata; Pittavaha Siras are warm and blue in colour; Kaphavaha Siras are white and stable. Raktavaha Siras are red in colour neither very hot nor very cold moderately warm.

सप्तसिराशतानि भवन्ति याभिरिदं शरीरमाराम इव जलहारिणीभिः केदार इव च

कुल्याभिरूपस्निह्यतेऽनुगृह्यते चाकुञ्चनप्रसारणादिभिर्विशेषैदुमपत्रसेवनीनामिव च
तासां प्रतानाः तासां नाभिर्मूलं ततश्च प्रसरन्त्यर्ध्वस्तिर्यक् च |

सु. शा. ७क्र२

There are 700 Siras. As a garden or grain field is made wet by the water carrying big and small channels, similarly the Siras by their contractility and

dilatory properly, supply nutrition to the body. They spread all over the body just like small and minute laminas arising from the central core of the leaf. They originate from the Nabhi and thereby spread all over the body upwards, downwards and obliquely.

The veins which are bluish-red in colour, small, full and sometime empty momentarily and having throbbing (pulsation) are carrying blood mixed with Vata, those which are warm to touch, of quick moment, bluish-yellow in colour are carrying blood mixed with Pitta; mixture of these signs indicate mixture of Doshas. Those which are deep seated, evenly placed, smooth and of slight red colour are carrying pure blood.

Sira Karya

Vatavaha Sirakarya

□ाणामप्रतीघातममोहं बुधिकर्मणाम् □
करोत्यन्यान गुणांश्चापि स्वाः सिराः पवनश्चरन् □
यदा तु कुपितो वायुः स्वाः सिराः प्रतिपद्यते □
तदाऽस्य विविधा रोगा जायन्ते वातसंभवाः □

सु. शा. ७क्र७ ८

Vata circulating in their Siras performs physical functions without any obstruction, promotes the intellect to work proper and prevents the mental deviations. When aggravated Vayu occupies its own Siras, it causes various disorders of Vata.

Acharya Dalhana has explained the term 'Kriyanam' in the following way – कायि□ाणां प्रसारणाकुञ्चनादीनां वाक्□ाणां भाषितादीनाम् □This includes both voluntary action and involuntary action.

The word 'Buddhi Karma' is related with the five sense organs and Manas. The intellect plays its role for taking decision in the normal state. When there is hindrance in the normal functioning of these sense organs. It is supposed

that there is something wrong with the Buddhi or it has gone under Moha. The Vatavaha Siras perform other actions along with functions already described.

Pittavaha Sirakarya:

भ्राजिष्णुतामन्न□विमाग्निदीप्तिमरोगताम् □

संसर्पत्स्वाःसिराःपितंकुर्याच्च्वन्यान्गुणानपि □

यदा प्रकुपितं पित्तं सेवते स्ववहाः सिराः □

तदाऽस्य विविधा रोगा जायन्ते पित्तसंभवाः □सु . शा . ७क्र७

Pitta, circulating in its own Siras, gives glow to the body, taste of food, maintains the digestive power and increases the immunity against diseases. Pitta when aggravated, moves in its own Siras, produces various disorders of Pitta.

Kaphavaha Sirakarya

स्नेहमङ्गेषु सन्धीनां स्थैर्यं बलमुदीर्णताम् □

करोत्यन्नान् गुणांश्चापि बलासः स्वाः सिराश्चरन् □

यदातुकुपितः श्लेष्मा स्वाः सिराः प्रतिपद्यते □

तदाऽस्य विविधा रोगा जायन्ते श्लेष्मसंभवाः □सु . शा .७क्र११ १२

Kapha, circulating in its own Siras maintains the viscosity of various parts of the body, stability to the joints, increases the strength and immunity and performs its other normal functions. When aggravated Kapha occupies its own Siras, various diseases caused by Kapha appear.

Raktavaha Sirakarya

धातूनां पूरणं वर्ण स्पर्शज्ञानमसंशयम् □

स्वाः सिराः संचरद्रक्तं कुर्याच्च्वान्यान् गुणानापि □

एदा तु कुपितं रक्तं सेवते स्ववहाः सिराः □

तदास्य विविधा रोगा जायन्ते रक्तसंभवा □

सु . शा .७क्र१४

Rakta circulating in its own Siras, nourishes all Dhatus gives colour to the body, receives tactile sensations and performs its other normal functions. When aggravated blood circulates in its own Siras, various disorders of blood occur.

Sira Sarvavahatvam:

नहि वातं सिराः काश्चिन्न पित्तं केवलं तथा |

श्लेष्माणं वा वहन्येता अतः सर्ववहाः स्मृताः □

प्रदुष्टानां हि दोषाणां मूर्च्छितानां प्रधावताम् |

धुवमुन्मार्गगमनमतः सर्ववहाः स्मृताः □ सु . शा . ७/१५-१६

Even though Vata, Pitta, Kapha and Rakta vaha Siras are described, it is also further classified that there are no exclusive Vatavaha or Pittavaha or Kaphavaha or Raktavaha Siras; whereas all the Siras carry all of them. In abnormal conditions like Sira Shareera aggravation of vitiation and vitiation of Dosha, they may circulate in different direction and different channel.

Sira Sankhya

According to Vagbhata

Mula Siras:

दश मूलसिराहृदयप्रतिबद्धाः सर्वांगप्रत्यङ्गन्योजो नयन्ति □

तत्प्रतिबद्धा हि शारीरचेष्टाः □ तास्तु द्वयङ्गुलमङ्गुलमर्धाङ्गुलं यवं यवार्धं च गत्वा

दुमपत्रसेवनीप्रतानवभ्दिद्यमानाः सप्त शतानि भवन्ति □

अ . सं . शा . ६क्र३-४

Ten Mula sira which are connected to the heart, transport Ojas to all the major and minor parts of the body. All the activities of the body are dependent on them. They dividing themselves to the size of two Angula, one Angula, half Angula, Yava, half Yava and so on, just like ribs and veins of a leaf become seven hundred.

Doshanusara Siras-

तासां यथास्वं तुर्यांशविभागेन पञ्चसप्तत्यधिकं शतकमनिलरक्तं वहति □

एष विभागः पित्तश्लेष्मशुद्धरक्तेष्वपि □

स्थिता ह्येवं देहमनुगृह्यन्ति दोषाः □

व्यत्ययेन तु पीडयन्ति □

अ.सं. शा. ६क्र२२

Raktayukta Vayuvaha Siras – 175, Raktayukta Pittavaha Siras – 175, Raktayukta Kaphavaha Siras - 175 and Raktayukta Shuddha Raktavaha Siras - 175 thus total siras are – 700. All Doshas with their normal state, they nourish the body, while on other hand, if they vitiated cause trouble to the body.

According to Ashtanga Sangrahkar Guda and Medhragata Siras – 32, Parshwagata Siras – 16, Prustagata Siras –24, Udaragata Siras – 24, Chest – 40, Greevagata – 24, Hanugata – 16, Jihwagata–16. Nasagata– 24, Netragata – 65, Karnagata – 16, Shiragata – 20.

According to Sushruta

तासां मूलसिराश्चत्वारिंशत् तासां वातवाहिन्यो दशः

पित्तवाहिन्यो दश□ कफवाहिन्यो दश□ दश रक्तवाहिन्यः □

तासां तु वातवाहिनीनां वातस्थानगतानां पञ्चसप्तातिशतं भवति□

तावत्य एव पित्तवाहिन्यः पित्तस्थाने□ कफवाहिन्यश्च कफवाहिन्ये□

रक्तवाहिन्यश्च यकृतप्लीहो□ एवमेतानि सप्त सिराशतानि □

सु. शा.७क्र५

Doshanusara –

Out of seven hundred Siras, there are forty principal Siras. Out of these 10 carry Vata, 10 carry Pitta, 10 carry Kapha and 10 carry Rakta. The Vata carrying Siras, situated in the specific receptacle of that principal Vata, branch out in one hundred and seventy five smaller branches (ramifications). Similarly Pitta

carrying Siras at the site of Pitta, Kapha carrying at the site of Kapha and the blood carrying at the site of Yakrita and Pleeha are found branching in the same number. In this way there are seven hundred Siras.

(I)	Vatavaha Siras - 10	(II) Vatasthanagata Siras - 175
	Pittavaha Siras - 10	Pittasthanagata Siras – 175
	Kaphavaha Siras – 10	Kaphasthanagata Siras – 175
	Raktavaha Siras - 10	Raktasthanagata Siras – 175
	Moola Siras (Total) - 40	Total - 700

While commenting on this text, Ghanekar has said that the above description regarding the classification of Siras on the basis of Doshas doesn't mean that the forty Siras originates from Nabhi or Hridaya. By this Sushruta meant that Vatavaha Siras are those which are found in Vata predominating areas, such as Pakvashaya, Kati, Shroni, Sakti, Asthi, Sparshanendriya (skin). Similarly, Pittavaha and Kaphavaha Siras are found in Pitta and Kapha predominating areas respectively. To some extent the above comment seems to be correct, but Sushrutas' description regarding classification doesn't tally with the description given in modern books.

Shadanganusara

तत्र वातवाहिन्यः सिरा एकस्मिन् सक्थ्नि पञ्चविंशति एतेनेतरसक्थि बाहू च व्याख्यातौ □

विशेषतस्तु कोष्ठे चतुस्त्रिंशत् तासां गुदमेढ्राश्रिताः श्रोण्यामष्टौ द्वे द्वे पार्श्वयोः षट् पृष्ठे

तावत्य एव चोदरे दश वक्षसि □एकचत्वारिंशज्जत्रुण ऊर्ध्वं तासां चतुर्दश ग्रीवायां

कर्णयोश्चतस्त्रः नव जिव्हायां षट् नासिकायां अष्टौ नेत्रयोः एवमेतत् पञ्चसप्ततिशतं

वातवहानां सिराणां व्याख्यातं भवति □एष एव विभागः शेषाणामपि □

विशेषतस्तु पित्तवाहिन्यो नेत्रयोर्दश कर्णयार्द्वे एव रक्तवहाः कफवहाश्च □

एवमेतानि सप्त सिराशतानि सविभागानि व्याख्यातानि □□

सु. शा. ७क्र६

Shakhagata Siras

Vatavaha Siras	25X4	100
Pittavaha Siras	25X4	100
Kaphavaha Siras	25X4	100
Raktavaha Siras	25X4	100
Total		400

Koshtagata Siras

II	Vatavaha Siras	-	34
	Pittavaha Siras	-	34
	Kaphavaha Siras	-	34
	Raktavaha Siras	-	34
	Total		136
II	Guda, Shishna, Shroni	-	08
	Parshwa	-	04
	Prushta	-	06
	Udara	-	06
	Vaksha	-	10
	Total		34

Urdhvajatrugata Siras

I	Vatavaha Siras	-	41
	Pittavaha Siras	-	41
	Kaphavaha Siras	-	41
	Raktavaha Siras	-	41
	Total	=	164
II	Greeva		14
III	Karnagata	-	04
IV	Jihwagata	-	09
V	Nasika	-	06
V	Netragata	-	08
	Total	=	41

Vatavaha sira 100+34+41=175 Pittavaha sira- Netra-10, Karna-02

Raktavaha and Kaphavaha siras are same as Pittavaha sira.

According to Bhela, it is from the heart that Rasa issues forth and from this (step onwards), the latter goes to all the places. Heart is reached by the veins and therefore the veins are said to be born of heart. [This is a clear conception of the heart-artery, vein-heart cycle of circulation of blood in the body with heart as its centre]. Ten Dhamanis are attached to the heart. These after going just four inches become twenty (i.e. every one bifurcates). In this way these ten Dhamanis become sixty (i.e. every one of these bifurcates once again). There in, these sixty Dhamanis become three hundred thousand networks of Siras. This is as follows – a tree surrounded by branches comes down everywhere by the fruits and the large foliage (Palashas) or as when it gets stretched or extended down if struck by stones, in a similar way this tree of ramifying vessels gets extended by the (networks of) Siras (in the body of the person as these spread out everywhere). In each and every pit of the hair, there is the exit aperture of the Sira, from end of which trickles down the sweat.

Avedhya Siras

अत ऊर्ध्व प्रवक्ष्यामि न विध्येद्याः सिरा भिषक् □

वैकल्यं मरणं चापि व्यधात्तासां ध्रुवं भवेत् □

सिराशतानि चत्वारि विद्याच्छाखासु बुध्दिमान् □

षट्त्रिंशच्च शतं कोष्ठे चतुःषष्टिं च मूर्धनि □

शाखासु षोडश सिराः कोष्ठे द्वात्रिंशदेव तु □

पञ्चाशज्जत्रुणश्चोर्ध्वमव्यध्याः परिकीर्तिताः □

सु. शा.७क्र१८- २०

Out of 700 Siras, four hundred are in the extremities, of which sixteen are not to be cut, one hundred and thirty six are in the trunk, of which thirty two are not to be cut, one hundred and sixty-four are at the top, of which fifty are not to be cut. Those veins which the physician should not puncture, deformity and death are sure if these are punctured. The wise physician should know that four hundred (400) veins are present in the Shakhas, 136 in Koshta and 164 in Urdhvajatrugata.

Among these 16 are in extremities. Koshtagata-32, Urdhvagata – 50, are to be considered as not suitable for puncturing.

Shakhagata Siras	16
Koshtagata Siras	32
Urdhvagata Siras	50
Total Avedhya Siras	98

Shakhagata Avedhya Siras

तत्र सिराशतमेकस्मिन् तासां जालधरा त्वेका तिस्त्रश्चाभ्यन्तराः तत्रोर्वीसंज्ञा चैका एतास्त्वव्यधाः एतेनेन्तरसक्थि बाहू च व्याख्यातौ एवमशस्त्रकृत्याः षोडश शाखासु □

सु. शा.७क्र२१

There are hundred Siras in one Sakti, among these one Sira is Jaladhara and internal Siras known as Urvis and one Lohitaksha. They are not fit for venesections. This description is applicable to the opposite Sakti, in this way Siras in Shakhas are sixteen. Comments- Dr Bhaskar Govind Ghanekar has accepted great saphenous vein in lower extremities and cephalic vein in upper extremity as Jaladhar. Femoral vein in lower extremity have been considered as Urvi and Lohitaksha Sira. So for as cephalic can and basilar vein are concerned they are superficial structure; therefore, they are to be protected. Femoral and brachial vein are deep seated structures and should not be taken for venesection. Venesection is to be performed only where there are minute veins present. Therefore, Sushruta's version of contraindicated Siras is practicable.

Koshtagata Avedhya Sira

द्वात्रिंशच्छोण्यां तासामष्टावशस्त्रकृत्याः द्वे द्वे विटपयोः कटीकत□ायोश्च □

अष्टावेकैकस्मिन् पार्श्वे तासामेकैकामूर्ध्वगां परिहरेत् पार्श्वसन्धिगते च द्वे □

चतस्त्रो विंशितिश्च पृष्ठे पृष्ठवंशमुभयतः तासामूर्ध्वगामिन्यौ द्वे द्वे परिहरेत् बृहतीसिरे □

तावत्य एवोदरे तासां मेढ्रोपरि रोमराजीमुभयतो द्वे द्वे परिहरेत् □

चत्वारिंशद्वक्षसि तासां चतुर्दशाशस्त्रकृत्या हृदये द्वे द्वे द्वे स्तनमूले स्तनरोहितापलापस्तम्भेषूभयतोऽष्टौ एवं द्वात्रिंशदशस्त्रकृत्याः पृष्ठोदरोरःसु भवन्ति ।

सु. शा.७क्र२२- २६

There are thirty two siras in the shroni, out of these are not be cut, such as two in the two Vitap and Katiktaruna. There are eight siras in each parshva, out of these two (one on each flank) spreading upward and two in the parshvasandhi, one in each flank are not to be punctured.

There are twenty four siras in prushth present in both sides of the vertebral column, out of these brihati sira two-, one on each side spreading upward should be avoided from puncturing.

In Udar also the same number of (twenty four) siras are present, out of these two on each sides situated above the penis near the line of hairs should be avoided.

In the Vaksha, there are forty siras, among these fourteen are not to be injured by sharp instruments (punctured)- such as two in the heart, two each in sthanamula, sthanrohita, apalapa and apasthambha, thus eight on each sides. Thus siras of prushth udar and vaksha which are not to be punctured are thirty two.

Jatrugata Avedhya Sira

चतुः षष्टिसिराशतं जत्रुण ऊर्ध्वं भवति तत्र षट्पञ्चाशच्छिरोधरायां तासामष्टौ चतस्त्रश्च मर्मसंज्ञाः परिहरेत् द्वे कृकाटिकयो द्वे विधुरयो एवं ग्रीवयां षोडशाव्यध्याः ।

हन्वो□भयतोऽष्टावष्टौ तासां तु सन्धिधमन्यौ द्वे द्वे परिहरेत् ।

षट्त्रिंशज्जिव्हायां तासामधः षोडशाशस्त्रकृत्याः रसवहे द्वे वाग्वहे च द्वे ।

द्विर्द्वादश नासायां तासामौपनासिक्यश्चतस्त्रः परिहरेत् तासामेव च तालुन्येकां मृदाखुद्देशे ।

अष्टत्रिंशदुभयोर्नेत्रयोः तासामेकैकामपाङ्गयोः परिहरेत् ।

कर्णयोर्दश तासां शब्दवाहिनीमेकैकां परिहरेत् ।

नासानेत्रगतास्तु ललाटे षष्टिः तासां केशान्तानुगताश्चतस्त्रः परिहरेत् आवर्तयोरेकैका स्थपन्यां चैका

परिहर्तव्या □

शङ्खयोर्दश तासां शङ्खसन्धिगतानामेकैकां परिहरेत् □

द्वादश मूर्ध्नि तासामुत्क्षेपयोर्द्वे परिहरेत् सीमन्तेष्वेकैकाम् एकामधिपताविति एवमशस्त्रकृत्याः पञ्चाशज्जत्रुण ऊर्ध्वमिति □

सु. शा. ७क्र२७- ३५

There are one hundred sixtyfour siras above the shoulders, out of these fifty six in the greeva, among these eight and four known as marma are to be avoided; two in the krukatika and two in vidhura; thus sixteen siras in the greeva are not to be punctured. (eight matruka, two nila and two manya- these have been mentioned as marma adding two each in krukatika and vidhura make up the number sixteen).

There are eight siras on each side of the hanu, out of these sixteen, sandhi and dhamani two on each side are to be avoided.

There are thirty six in tongue, out of these sixteen which are below the tongue are not to be injured by instruments, the two rasavaha and two vakvaha are also not to be punctured.

In the nasa there are twenty four siras, out of these, four which are aupanasika are to be avoided; out of these only one sira in the soft palate also should be avoided.

Siras in both the eyes together are thirty eight; out of these, one in each apanga are to be avoided.

Siras in both the ears together are ten; out of these sabdavahini sira, one in each ear should be avoided.

Siras spreading to the nose and eyes- twenty four of the nose and thirty six of the eyes- totaling sixty are present in the forehead. These follow the border of the hairs; out of these one each in the avarta and one in the sthapani are to be avoided.

There are ten siras in the two shankha together; out of these one situated at the joint of the shankha should be avoided.

There are twelve siras in the head; out of these two in the two utkshepa, one each the simanta (five) and one in the adhipati are to be avoided.

Thus fifty siras present above the shoulders are not to be injured by sharp instruments.

Differentiations between Sira, Dhamni and Srotas

चतुर्विंशतिर्धमन्यो नाभिप्रभवा अभिहिताः □तत्र केचिदाहुः सिराधमनीस्त्रोतसामविभागः सिराविकारा एव हि धमन्यः स्त्रोतांसि चेति □तत्तु न सम्यक अन्या एव हि धमन्यः स्त्रोतांसि च सिराभ्यः कस्मात् व्यञ्जनान्यत्वान्मूलसन्नियमात् कर्मवैशेष्यादागमाच्च केवलं तु परस्परसन्निकर्षात् सद्दशागमकर्मत्वात् सौक्ष्म्याच्च विभत्ककर्मणामप्यविभाग इव कर्मसु भवति □ सु. शा. ९क्र२

धमन्यो नाभिसम्बद्धा विंशतिश्चु□त्तरा □

ताभिः परिवृता नाभि श्च□ताभिरिवारकैः □

ताभिश्चोर्ध्वमधस्तिर्यग्देहोऽयमनुह्यते □

अ.हृ. शा. ३क्र३९

It has been stated earlier that there are twenty four dhamani, arising from Nabhi. On that, some scholars say Sira Dhamani and Srotas are not different and dhamani and srotas are the vikara of sira only. This is not correct. Dhamanis and srotas are different from sira. It is because of

(1) Vyanjananyatva (difference in their features)

(2) Mula sanniyama (sifferenc in number of their place of origin)

(3) Karma vaishasya (functions special to each) and

(4) Agama (description in scriptures-treatises of Ayurveda)

But because of sannikarsha (nearness), sadrushyaagamatva (similarities of description in texts), sadrushya karmatva (similarity of functions) and saukshmya (minuteness) these though actually performing different functions yet appear to be not different.

Acharya Dalhana explains these reasons as follows:

Reasons of difference-

1. Difference in features- sira carrying vata, pitta, kapha and Rakta are described as light red, blue white and deep red in colour respectively, whereas dhamani are described as having no colour and srotas as having the same colour of the dhatu in which they are present.
2. Number at origin- at their site of origin sira is described as forty in number, where as dhamani are twenty four and srotas are twenty two.
3. Special functions- performing all the functions of the body mind and intellect without any hinderance (interruption) is the function of sira, where as functions of dhamani are perception of objects of senses and those of srotas are purveying air, water, food rasa etc.
4. Description in texts-treatises of Ayurveda has mentioned sira, dhamani and srotas separately at many places. Hence dhamani, srotas are different from sira.

Reasons for confusion

Identifying these as one and the same are due to:

1. Nearness –as for eg. Burning of blades of grass placed nearer to one another though burning separately, yet appear as though all are burning together.
2. Similarity of description in texts- as for example the statement that vacant places sira dhamani, srotas, marga etc all belong to akashbhuta group since there is space inside them.
3. Similarity of functions- for example melody of each member of an orchestra though different individually, still appears to one when combined together.
4. Minutness –though each one of the innumerable atoms of mud present in apot are supporting the water in the pot, still they are not recongnised separately.

The word Sira is derived from "sZ" which means move slowly therefore Sira means channels in which there slow movement. From these point of view Dhamanis are arteries, Siras are veins and Srotases are lymphatics. In many passages, Charaka and Sushruta unanimously quote about plenty of portions. Sushruta uses the term Sira in various places to imply veins in whole of chapter on"Sira Vyadhavidhi Adhyaya". On the basis of this it denotes that the Sira is vein. Judging thus from majority of instances occurring in various places of Charaka and Sushruta the traditional meaning of Dhamanis appears to be channels from heart. And of the term "Sira" may be veins. At the same time the term Dhamani has been imply nerves in many passages of Sushruta Sharira Sthana 9th chapter.

Generally speaking however it is thought Dhamani as artery, Sira as vein commonly. So it is clear for learned people should over look deliberately to give a clear statement Siravarna Vibhakti:

Table Showing Classification of Siras According To Varna

Sr. no.	Siraprakara	Siraktrarya	Triosha drushtya vargikaran
1.	Rohinyaha	Nourshing body by upasnehana	Artery –Anugrahana pittavahinya
2.	Neela	Nourshing body by upasnehana	Veins - Anugrahana pittavahinya
3.	Gourya	Nourshing body by upasnehana	Lymphatics - Anugrahana kaphavahinya
4.	Aruna	Akunchana prasaranadi karmas	Autonomic nerves – vatavahinya

Transmitter category of author Pandit Gangadhar Shastri shows classification of Siras. For an instance, he makes the blood vessels identical with Pittavaha Sias and divides them into two classes, which he calls by two specific terms “Rohini” and“Neela”. He also includes lymphatics and autonomic nerves in the same table given above. The Pittavaha Siras have been clearly shown as Raktavahinis. Sushruta divide sthe Siras as Vatavahi, Pittavahi, Kaphavahi and Raktavahi.

The fundamental difference between Dhamani v/s Sira and Srotas is act of Dhamana or pulsation. Thus, Dhamani is recognized by Dhamana action. Sira is the tubular structure, where Sarana is performed and through this Rasa Dhatvadi fluids flows through Sira. The “Sarana” in this reference explains the flow of various fluids through Sira onwards. Srotas are the structures through which Sravana occurs.

REVIEW OF SIRAVYADHA

सिनौतौति इति सिरा □व्यधनमिति व्यधः □

सरत्याभी रक्तमिति सिराः □तासां व्यधः सिराव्यधः□

That which binds or a quantity bound together

It is formed from the root, षिञ् →to bind

- षिञ् □बन्धने□+ रक् →सिरा
- Any tubular vessel of the body – nerve, vein, artery, tendon;

As they are binding the whole body together by transporting blood to all over the body.

व्यधः To cut, to pierce, to hit

By which the blood is being taken all over the direction is isara. Its piercing is known as सिराव्यधः .

Raktamokshana

The word Rakta means- blood and The word Mokshana is derived from the root, Moksha means to relieve or to let out.

Therefore letting out of blood is known as Raktamokshana.

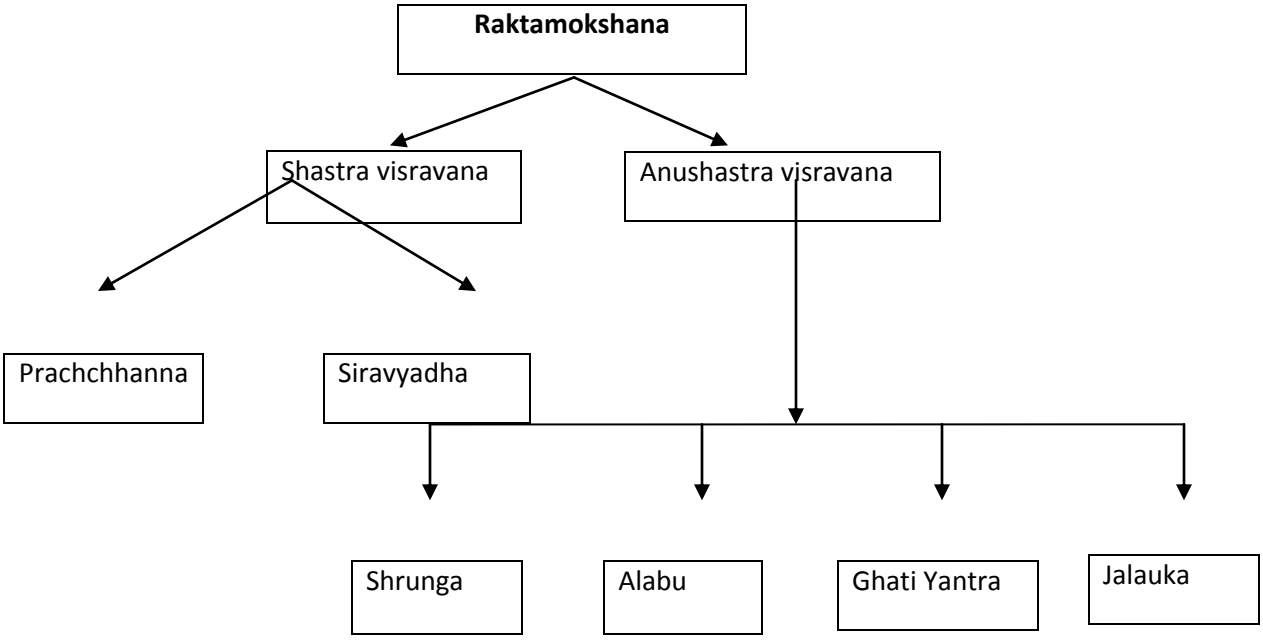
शस्त्रविस्रावणं द्विविधं प्रच्छानं सिराव्यधनं च □

सु. सू. १४ क्र २५

तत्र ऋज्वसंकीर्णं सूक्ष्मं सममनवगाढमनुत्तनमाशु च शस्त्रं पातयेन्मर्मसिरास्नायुसन्धीनां चानुपघाति □□

सु. सू. १४ क्र २६

The process of raltamokshana can be traced back to Vedic period only and not beyond that. In the koushika sutra of atharvaveda, references of raktamokshana by leech application are found.



Raktamokshana is of two types –

1) **Shastra-Visravana -** It is the process which is done by the iron instruments. It is of two types:

i) Prachana: It should be done in straight line, such lines not joining together, being even, not very superficial. The instrument should be used quickly without damaging vital spots and joints.

ii) Siravyadha: It is the procedure of puncturing a vein.

2) **Anushastra-Visravana-** It is more preferable for delicate persons because they are not made by iron instruments etc. It consists of four methods –

i) Jalauka

ii) Shrunga

iii) Alabu

iv) Ghati Yantra

Acharya Vagbhata has considered the Anusastra as Jalauka, Kshara, Daha Karma, Kacha, Nakha, PashSna etc. and suggested to treat similarly.

तत्र पाददाहपादहर्षावबाहुकचिप्पविसर्पवातशोणितवातकण्टकविचर्चिकापाददारीप्रभुतिषु क्षिपमर्मण उपारिष्टाद् द्वयङ्गुले वीहिमुखेन सिरां विध्येत् श्लीपदे तच्चिकित्सिते यथा वक्ष्यते कोष्टुकुशिरः खञ्जपङ्गुलवातवेदनासु जङ्घायां गुल्फस्योपरि चतुरङ्गुले अपच्यामिद्रबस्तेरधस्ताद् द्वयङ्गुले जानुसन्धेरूपर्यधो वा चतुरङ्गुले गृध्रस्याम् ऊरूमूलसंश्रितां गलगण्डे एतेनेतरसक्थि बाहु च व्याख्यातौ ।

सु. शा. ८क्र २६

गलगण्ड ऊ□मूलसंक्षिताम् □गृधस्या जानुसन्धे□पर्यधो वा चतुरङ्गुले □

अपच्यामिन्द्रबस्तेरधस्तात् द्व्यङ्गुले □□ष्टुकशीर्षे सक्थिवात□जासु च □

गुल्फस्योपरिष्टाच्चतुरङ्गुले □बाहहर्षचिप्पवातशोणितवातकण्टकविपादिकापाददारीप्रभृतिषु

पादरोगेषु क्षिप्रमर्मण उपरिष्ठात् द्व्यङ्गुले □

अ. सं. सू. ३६ क्र ८

SIRAVYADHA STHANAS ACCORDING TO SUSHRUTA AND VAGBHATA

Sr. no.	**Disease**	**Sushruta (vedhya sira)**	**Vagbhata (vedhya sira)**
1	Padadaha, Padaharsha, Chippa, Vatarakta, Padadari, Vatakantanka, Avabahuka	2 angula above from Kshipra marma	Except Avabahuka, Visarpa, Vicharchika others are according to Sushruta
2	Krashrukasheersha, Kanja, Pangu	4 angula above from Gulpha in Jangaha	Except Kanja, Pangu others according to Sushruta
3	Grudhrasi	4 angula above or below from Janu sandhi	According to Sushruta

4	Mootra Vriddhi	Behind Vrishana sthita sira	-----
5	Jalodara	4 angula behind from Nabhi vama parshwa	-----
6	Antravidhradhi, Parshwashoola	Sira in between Vaksha & sthana	According to Sushruta
7	Bahushosha, Avabahuka	Sira in between two Amsas	------
8	Truteeyak Jwara	Sira in between Trikasandhi	According to Sushruta
9	Chaturtak Jwara	Below Amsasandhi	-------
10	Apasmara	Below Hanusandhi	According to Sushruta
11	Unmada	Between Keshanta & Shankha or Urahapradesha or Lalata or sira of Apanga	Vraha, Apanga & Lalata
12	Jeehwaroga, Dantaroga	Sira below Jeehwa	-----
13	Mukharoga	------	Sira being in Jeehwa, Oshtha, Hanu & Talu
14	Taluroga	Talugata sira	------
15	Karnaroga	Sira above Karna	Karnagata sira vyadhana
16	Nasaroga	Nasagra sira	According to Sushruta

17	Peenas	------	In between Nasa & Lalata
18	Timira, Akshipaka, Shiro roga, Adhimanta	Upanasika sira, lalata sira , apanga sira	According to Sushruta
19	Jatroordhava Granthi	------	Greeva Karna, Shiragata sira

Indications of Siravyadha

त्वग्दोषा ग्रन्थयः शोफा रोगाः शोणितजाश्च ये □

रक्तमोक्षणशीलानां न भवन्ति कदाचन □सु. सू. १४क्र३४

Diseases of the skin, tumours, swelling and diseases arising from blood will never occur in persons indulging in bloodletting (generally in Sarad Ritu).

Bloodletting is the method of treatment indicated in diseases caused due to the vitiation of Raktadhatu like Visarpa (erysipelas), Vidradhi (abscess), Pliha (Diseases of Spleen), Gulma, Agnisadana (Dyspepsia), Jwara (Fever), Mukha Roga (Diseases of mouth), Netra Roga (Diseases of Eye), Siro Roga (Diseases of Head), Mada (Intoxication), Trishna (Thirst), Lavanasyata (Salty taste in the mouth), Kushta (Skin diseases), Vatarakta, Raktapitta, Katu and Amlodgara (Pungent and Sour eructation), Bhrama (Giddiness) etc.

Contraindications of Siravyadha

बालस्थविररूक्षक्षतक्षीणभीरूपरिश्रान्तमद्याध्वस्त्रीकर्षितवमितविरिक्तस्थापितानुवासितजागरित□

क्लीबकृशगर्भिणीनां कासश्वासशोषप्रवृद्धज्वरक्षेपकपक्षाघातोपवासपिपासामुर्च्छाप्रपीडितानां च □

सु. शा. ८क्र १

Siravyadha should not be done in the following persons:

- Bala (very young) and Sthavira (very old), as they are weak and the Dhatus are in an immature state;

- Ruksha, Kshatakshina (wounded and debilitated), as it may cause "Vataprakopa";
- Bhiru (timid persons), as there will be "Tamobahulata", and faint by seeing the blood;
- PariSranta (tired persons), as Vata gets vitiated in such persons and affects the whole body;
- Madyapa (alcoholics), as they will go to Murccha again due to the intoxicated condition;
- AdhvastrikarSita (emaciated as a result of long journey and sexual intercourse), as it may cause "Vataprakopa";
- Vamita and Virikta (those who have undergone Vamana and Virechana therapies), as it may aggravate Vata;
- Asthapita and Jagarita (those who have undergone Asthapanavasti and who have not slept at night), as it may further aggravate Vata;
- Anuvasita (those who have undergone Anuvasanavasti), as there will be Mandagni which leads to "Agnimandya";
- Kliba (impotent), as there will be Sukrakshaya along with Alpasattva which will definitely lead to VinaSa of such person;
- Krisha and Garbhini (emaciated and pregnant women), as there will be Dhatukshaya in both cases;
- Kasa and Swasa, as the Dhatus are in Apachiyavastha which may lead to complications;
- Pravruddha Jwaravastha (chronic fevers), as it leads to complications such as Pralapa etc.
- Akshepaka Vata, Pakshaghata Those who observe Upavasa (fasting) and those who are afflicted with Pipasa and Murccha.

प्रतिषिद्धानामपि च विषोपसर्गात्ययिकेषु सिराव्यधनमप्रतिषिद्धम □

सु. शा. ८क्र ४

Those veins which are prohibited from puncturing (Avedhya Siras), which are invisible though indicated for puncturing, which are visible but not controlled

(from moving apart), which are not raised (engorged by pressure from a tourniquet etc.) though controlled, such veins should not be punctured. As bloodletting is very necessary in the above mentioned diseases ideally, leeches should be applied; however Siravyadha is the last choice. Even in those who are prohibited for it, when they are affected by poisons or are in an emergency, Siravyadha can be done.

नैवातिशीते नात्युष्णे न प्रवाते न चाभ्रिते □

सिराणां व्यधनं कार्यमरोगे वा कदाचन □

सु. शा. ८क्र ६

अथाविस्त्राव्याः सर्वाङ्गशोफः क्षीणस्य चाम्लभोजननिमित्तः पाण्डुरोग्यर्शसोदरीशोषिगर्भिणीनां च श्वयथवः □

सु. सू १४क्र २४

Siravyadha should not be done on days which are very cold, very hot, with heavy breeze and very cloudy and never in the healthy persons (except Sarad Ritu). Also, those who have swelling all over the body, who are emaciated due to intake of sour food (for a long time), who are suffering from disease such as anaemia, haemorrhoids, abdominal enlargement, tiredness, oedema and pregnant women.

Importance of Marma in the context of Siravyadha

सिराशतानां सप्तानां शरीरेषु शरीरिणाम् □

अशस्त्रकृत्या नवतिस्तथाऽष्टौ च विनिर्दिशेत् □

स्पन्दिन्यो जलधारिण्यो याश्च मर्मसमाश्रिताः □

सु. शा. ७

वैकल्यं मरणं चापि व्यधात्तासां ध्रुवं भवेत् □

सु. शा. ७क्र१९

While explaining the contraindications of Siravyadha, SuSruta in Sarirasthana, describes that the Avedhya Siras in each of the lower extremities are 4 in number; i.e. Jaladhara – 1, Urvi – 2, Lohitaksha – 1 and these are considered as MarmaSrita and hence should not be venesected. If venesected, it may cause disability or death.

Materials required for Siravyadha

प्रागेव चोपकल्पयेच्छयनासनोदकुम्भवस्त्रपादि □

तथा यथालाभं च तगरैलाशीतशिवकुष्ठपाठाविडङ्गभद्रदा□

त्रिकटुकागारधूमहरिद्रार्काङ्कुरनक्तमालचूर्णमसृक्स्रावणाय □

लोध्रमधुकप्रियङ्गैरिकरसाञ्जनशाल्मलीशङ्खयवगोधूममाषचूर्णम् □

वटाश्वत्थाश्वकर्णपलाशविभीतकसर्जार्जुनधन्वधातकीसालसारारिमेदतिन्दुक

त्वगङ्कुरनिर्यासश्रीवेष्टक मृत्कपालमृणालाञ्जनचूर्णम् □

क्षौममषीलाक्षासमुद्रफेनचूर्ण वा □तथान्यच्चातिसुतरक्तव्यापत्प्रतीकारोपकरणम् □□

अ. सं. सू. ३६क्र९

For better performance of Siravyadha and for the management of the complications, the following materials should be arranged prior to the procedure: Cot, Stools, pots of water, pieces of cloth (gauze piece, swabs), drugs like Tagara, Ela, Sita, Siva, Kushta, Patha, Vidanga, Bhadradaru, Trikatu, Agaradhuma,Haridra, Arkankura, Churna (slaked lime) etc. to promote bleeding; drugs like Lodhra, Madhuka, Priyangu, Gairika, Rasanjana, Salmali, Sankha Churna, Yava, Godhuma, Masha, Churna (slaked lime), Vata, ASwattha, ASwakarna, PalaSa, Vibhitaka, Sarja, Arjuna, Dhanwana, Dhataki, Salasara, bark of Arimeda, sprout and latex of Tinduka, Sriveshtaka, Mrtkapala (potsherds), Mrinala, powder of Anjana (Antimony sulphide), ashes of Kshauma, Laksha or powder of Samudraphena and also any other substances useful to stop bleeding and its complications.

Vyadhana Pramana

मांसलेष्ववकाशेषु यवमात्रं शस्त्रं निदध्यात् अतोऽन्येष्वर्धयवमात्रं व्रीहिमात्रं वा

व्रीहिमुखेन अस्थ्नामुपरि कुठारिकया विध्येदर्धयवमात्रम् ▯ सु. शा. ८क्र १८

In muscular areas, puncturing should be of the size of the Yava (barley grain) in other areas it should ½ Yava or one Vrihi (rice) using a Vrihimukha Sastra.
Veins on the bones should be punctured to the size of ½ of Yava using a Kutharika Sastra.

Vyadhana Kala for Siravyadha

व्यभ्रे वर्षासु विध्येत ▯तु ▯ग्रीष्मकाले तु शीतले ▯

हेमन्तकाले मध्यान्हे शस्त्रकालास्त्रयः स्मृताः ▯

सु. शा. ८क्र १९

Three suitable times of Siravyadha are mentioned. During Varsha Ritu (rainy season), it should be done on days which are not cloudy; during Grishma Ritu (summer season) at the time which is cool; during Hemanta Ritu (winter season) at mid-day.

Siravyadha Vidhi

तस्मान्न शीते नात्यष्णे नास्विन्ने नातितापिते ▯

यवागूं प्रतिपीतस्य शोणितं मोक्षयेभ्दियक् ▯

सु. सू. १४क्र ३१

Bloodletting should be done by the physician on the day which is neither very cold nor very hot, neither before sudation (Swedana) therapy nor after too much of sudation. It should be adopted after the patient has been satisfied with a drink of Yavagu (thin gruel) mixed with ghee or oil.

Samyak Vidha Lakshanas

सम्यक्शस्त्रतिपातेन धारया या स्त्रवेदसृक् □

मुहूर्त रूद्धा तिष्ठेच्च सुविद्धां तां विनिर्दिशेत् □

यथा कुसुम्भपुष्पेभ्यः पूर्व स्त्रवति पीतिका □

तथा सिरासु विद्धासु दुष्टमग्रे प्रवर्तते □

सु. शा. ८क्र २० □१

When proper instrumentation (puncturing) has been done, blood flows out in a stream for a period of one Muhurta and then stops on its own accord; this should be understood as proper puncturing. Just as yellow liquid flows out first from flowers of Kusumbha (when crushed) similarly vitiated blood flows out first when veins are punctured62. When the blood stop by itself after adequate flow, then it should be considered as pure (un vitiated and as properly drained).

Asrava Dosha

तद्दुष्टं शोणितमनिर्ह्रियमणं शोफदाहरागपाकवेदना जनयेत् ||

सु. सू. १४क्र २९

If the vitiated blood is not let out (in sufficient quantity) it gives rise to Sopha (Swelling), Daha (Burning sensation), Raga (redness), Paka (ulceration) and Vedana (Pain).

Atisrava Dosha

अत्युष्णेऽतिस्विन्नेऽतिविद्धेऽज्ञैर्विस्रावितमतिप्रवर्तते तदतिप्रवृत्तं

शिरोऽभितापमान्धमधिमन्थतिमिरप्रादुर्भावं धातुक्षयमाक्षेपकं दाहं

पक्षाघातमेकाङ्गविकारं हिक्कां श्वासकासौ पाण्डुरोगं मरणं चापादयति □

सु. सू. १४क्र ३०

Siravyadha if done during the time of summer (excess heat), if Swedana has been done in excess, if the puncturing is very much and if done by an unskilled or inexperienced physician , then the blood flows out in great quantity.

Such excess flow of blood produces Sirobhitapa (Headache), Andhya (Blindness), Adhimantha, Timira, Dhatu kshaya, Akshepaka, Daha, Pakshaghata, Ekangavata, Hikka (Hiccough), Swasa, Kasa, Pandu and death.

Srava Pramana

बलिनो बहुदोषस्य वयःस्थस्य शरीरिणः □

परं प्रमाणमिच्छन्ति प्रस्थं शोणितमोक्षणे □

सु. शा. ८क्र२५

In persons who are strong and have great accumulation of Doshas and who have suitable age (middle age), maximum one Prastha (768 ml) of blood should be allowed to flow out after Siravyadha.

Dushta Vyadhana (Improper Puncturing)

अत ऊर्ध्वं दुष्टव्यधनमनुव्याख्यास्यामः तत्र दुर्विद्धाऽतिविद्धा कुञ्चिता पिच्चिता कुट्टिताऽ

प्रस्रुताऽत्युदीर्णाऽन्तेऽभिहता परिशुष्का कूणिता वेपिताऽनुत्थितविद्धा शस्त्रहता

तिर्यग्विद्धाऽपविद्धाऽव्यध्या विदुता धेनुका पुनः पुनर्विद्धा मांससिरास्नाव्यस्थिसन्धिमर्मसु

चेति विंशतिर्दुष्टव्यधाः □

सु. शा. ८क्र ३0

तत्र या सूक्ष्मशस्त्रविद्धाऽव्यक्तमसृक् स्रवति रूजाशोफवती च सा दुर्विद्धा□

प्रमाणातिरिक्तविद्धायामन्तः प्रविशति शोणितं शोणितातिप्रवृत्तिर्वासाऽतिविद्धा□

कुञ्चितायामप्येवम् कुण्ठशस्त्रप्रमथिता पृथूलीभावमापन्ना पिच्चिता□अनासादिता

पुनः पुनरन्तयोश्च बहुशः शस्त्राभिहता कुट्टिता□शीतभयमूर्च्छाभिरप्रवृत्तशोणिताऽप्रस्तुता□

तीक्ष्ण महाभुग्वशस्त्रविद्धाऽत्युदीर्णा□अल्परक्तस्रावेण्यन्तेविद्धा अन्तेऽभिहता□

क्षीणशोणितस्यानिलपूर्णा परिशुष्का□चतुर्भागा व सादिता किंचित्प्रवृत्तशोणिता

कूणिता□दुःस्थानबन्धनाद्वेपमानायाः शोणितसंमोहो भवति सा वेपिता

अनुत्थितविद्धायामप्येवं□छिन्नाऽतिप्रवृत्तशोणिता कियासङ्गकरी शस्त्रहता

तिर्यक्प्रणिहितशस्त्रा किंचिच्छेषा तिर्यग्विद्धा□बहुशः क्षता

हीनशस्त्रप्रणिधानेनापविद्धा□अशस्त्रकृत्या अव्यध्या□अनवस्थितविद्धा विद्रुता□

प्रदेशस्य बहुशोऽवघट्टनादारोहदव्यधा मुहुर्मुहुः शोणितस्रावा धेनुका□

सूक्ष्मशस्त्रंव्यधनाद्बहुशो भिन्ना पुनः पुनर्विद्धा□मांसस्नाय्वस्थिसिरासन्धिमर्मसु विद्धा

रूजां शोफं वैकल्यं मरणं चापादयति □□

सु. शा. ८क्र ३१

Dushta Vyadhana (Improper puncturing) is of twenty as follows:

1. Durviddha is that which puncture made by a minute sharp instrument, blood flow being invisible and having pain and swelling.
2. Atividdha is that puncture which is more than the required measurement, blood flow either goes inside the body of flows out in large quantity.
3. Kunchita is also similar to the above.
4. Picchita is that puncture which is made with a blunt instrument, the vein attaining thickness
5. Kuttita is that in which puncturing is done often, not getting blood and vein is hurt by the instrument.
6. Aprasrta is that in which blood flow does not occur due to cold, fear or fainting.
7. Atyudirna is that puncture made by a sharp and thick instrument.
8. Anteviddha is that puncture which causes scanty flow of blood.
9. PariSushka is that in which there is depletion of blood in the vein but it is filled with air.
10. Kunita is that in which quarter portion of the vein is punctured and little quantity of blood only flows out.
11. Vepita is that in which binding is made at improper place, puncturing done With trembling hand, giving rise to tremors of the body and loss of consciousness.
12. Anuthitaviddha is that in which the symptoms of Vepita occur.

13. Sastrahata is that in which the vein is cut, producing copious flow and stoppage of functions of the body part.
14. Tiryakviddha is that in which the instrument is pushed into the vein through its side and slightly.
15. Aviddha is that in which the instrument is used without making a wound (not puncturing at all).
16. Avyadhya is that in which the puncture is not done by the instrument.
17. Vidruta is that in which the puncturing is done when the physician is unsteady.
18. Dhenuka is that in which the body part is hit greatly many times to raise the vein and flow of blood occurs again and again.
19. Punahpunar Vidha is that in which the vein is punctured many times because of using a small (minute) sharp instrument.
20. Puncture done on ligaments, Bones, Veins, Joints and fatal spots (Marma) gives rise to pain, swelling, deformity or death.

Raktasrava Nirodha Karma (Methods of Preventing Bleeding)

चतुर्विधं यदेतद्धि □धिरस्य निवारणम् |

सन्धानं स्कन्दनं चैव पाचनं दहनं तथा □

व्रण कषायः संधत्ते रक्तं स्कन्दयते हिमम् |

तथा संपाचयेभ्दस्म दाहः संकोचयेत् सिराः ||

सु॰ सू॰ १४क्र ३९□o

There are four methods of preventing bleeding from the vein –

1. Sandhana – Joining the edges of the wound;
2. Skandana – Promoting clotting;
3. Pachana – Closing the wound;
4. Dahana – Burning or Cauterization

Drugs which are astringent will join or unite the wound; Drugs which are cold makes the blood to clot, Ash or Alkali drugs will adhere and closes the wound and Cauterization will constrict the veins.

REVIEW OF KSHIPRA MARMA

The word Marma denotes a point of vital importance in the body, a mortal, a vulnerable point or a sensitive point where vital force or life is situated.

मारयन्तीति मर्माणि □डल्हण टीका

अपि च मरणकारित्वान्मर्म □अष्टांगहृदय शारीर ७

According to Dalhana, marma is that spot on the body surface where if any injury or trauma is made cause death. Similar definition has been written in the seventh chapter of sharir of Ashtanga Hridaya.

मर्माणि नाम मांससिरास्नाय्वस्थिसन्धिसन्निपाताः तेषु स्वभावत एव विशेषेण

प्राणास्तिष्ठन्ति तस्मान्मर्मस्वभिहतांस्तान् भावानापद्यन्ते □□

सु शा.६/२२

The places where Mans, Sira, Snayu, Asthi and Sandhi all are present are called Marmas (vulnerable areas) which are specially and by virtue of their nature are the seats of Prana. Therefore any trauma on any one of these Marmas invariably causes death.

सप्तोत्तरं मर्मशतम् □ानि मर्माणि पञ्चात्मकानि भवन्ति. तद्यथा मांसमर्माणि. सिरामर्माणि.

स्नायुमर्माणि. अस्थिमर्माणि. सन्धिमर्माणि चेति. न खलु मांससिरास्नाय्वस्थिसन्धिव्यतिरेकान्यानि

मर्माणि भवन्ति. यस्मान्नोपलभ्यन्ते □□ सु.शा.६/२

तत्रैकादश मांसमर्माणि. एकचत्वारिंशत्सिरामर्माणि. सप्तविंशतिः स्नायुमर्माणि. अष्टावस्थिमर्माणि.
विंशतिः सन्धिमर्माणि चेति □तदेतत् सप्तोत्तरं मर्मशतम् □□

सु.शा.६/३

There are one hundred and seven marmas on the human body surface. These marmas are of five types. Such as Mans marma, Siramarma, Snayumarma,

Asthi marma and Sandhi marma. As a matter of fact marmas are none else than the mans, Sira, Snayu, Asthi and Sandhi, as they are not found elsewhere.

Out of them Mans Marmas are- 11, Sira marmas- 41, Snayu marmas-27, Asthi marmas-8 and Sandhi marmas-20. In this way the total number comes to one hundred and seven.

तत्पुमर्मासिरास्नावास्थिर सन्धिसन्निपातः □बाहुल्येन तु निर्देशः □तस्मान्मांसाद्याश्रयतो मर्माणि पञ्चधाभिद्यन्ते □अष्टांङ्ग संग्रह शारीर ७

In Asthanga hridaya Acharya Vagbhatta has mentioned six types of marmas. He added Dhamani Marmas to the Sushruta's list. Acharya Sushruta has used the arteries as well as veins under one heading sira. Vagbhatta has taken sira in a stricter sense of vien. Hence he has included one more type of marma under in a name of Dhamani. Besides this difference of opinion, Vagbhatta has approved the concept of Sushruta.

तेषामेकादशैकस्मिन् सक्थि बाहू च व्याख्यातौ. उदरोरसोद्वादश. चतुर्दश पृष्ठे.

ग्रीवां प्रत्यूर्ध्वं सप्तत्रिंशत् □

सु.शा.६/४

There are 11 marmas in each Sakti and Bahu. 12 marmas in Udar (abdomen) and Urasa (chest); 14 marmas in Prishtha (back) and 37 in the Greeva (neck) and the region above it.

तान्येतानि पञ्चविकल्पानि मर्माणि भवन्ति □तद्यथा सद्यःप्राणहराणि. कालान्तर प्राणहराणि. विशल्यघ्नानि. वैकल्यकराणि. रूजाकराणीति □तत्र सद्यःप्राणहराण्येकोनविंशतिः. कालान्तर प्राणहराणि त्रयस्त्रिंशत् त्रीणि विशल्यघ्नानि. चतुश्चत्वारिंशद्वैकल्यकराणि. अष्टौ रूजाकराणीति □

सु.शा.६/१४

The marmas are classified into five groups. They are Sadyah pranahar, Kalantarapranahara, Vishalyaghna, Vaikalykara and Rujakara. The Sadyah

pranahar marmas are 19 in number, Kalantara Pranahara are 33, Vishalyaghna 3, Vaikalykara 44 and Rujakara marmas are 8.

ऊर्व्यः शिरांसि विटपे च कक्षपार्श्वे एकैकमङ्गुलमितं स्तनपूर्वमूलम् □

विद्धयङ्गुलद्वयमितं मणिबन्धगुल्फं त्रीण्येव जानु सपरं सह कूर्पराभ्याम् □

हृद्वस्तिकूर्चगुदनाभि वदन्ति मूर्ध्नि चत्वारि पञ्च च गले दश यानि च द्वे □

तानि स्वपाणितलकुञ्चितसंमितानि शेषाण्यवेहि परिविस्तारतोऽङ्गुलार्धम् □

सु.शा.६/३९

These verses have been cited to describe the area of different marmas. Urvi, Kurcha sira, Vitap and Kaksadhara marmas mesure one finger each. Stana moola, manibandha, and gulf measure two fingers each. Hridaya, Vasti, Kurcha, Guda, Nabhi are four marmas of head, and five simantas, ten marmas of the neck. Two manya, two nila and seven matrika are measured equal to the size of the closed fist. The remaining marmas are thought to be measuring half finger only.

तत्र सक्थिमर्माणि क्षिप्रतलहृदयकूर्चकूर्चशिरोगुल्फेन्द्रबस्तिजान्वाण्यूर्वीलोहिताक्षाणि

विटपं चेति एतेनेतरत्सक्थि व्याख्यातम् □

सु.शा.६/५

बाहुमर्माणि तु क्षिप्रतलहृदयकूर्चकूर्चशिरोमणिबन्धेन्द्रबस्तिकूर्पराण्यूर्वीलोहिताक्षाणि

कक्षधरं चेति एतेनेतरो बाहुव्याख्यातः □

सु.शा.६/७

In the sakti (inferor extremity) the following marmas are found- Kshipra, Talahridaya, Kurcha, Kurcha-shir, Gulf, Indra-vasti, Janu, Ani, Urvi, Lohitaksh and Vitap. The same should be taken in other Sakti.

The following marmas are found in one limb- Kshipra, Talahridaya, Kurcha, Kurcha-shir, Manibandha, Indra-vasti, Kurpar, Ani, Urvi, Lohitaksh and Kaksdhara. This description is also applicable with another Bahu.

वक्षोमर्माणि सीमन्ततलक्षिप्रेन्द्रबस्तयः □

कटीकतरूणे सन्धीपार्श्वजौ बृहती च या □

नितम्वाविति चेतानि कालान्तरहराणि तु □

सु.शा.६/१६-१७

The Kalantar pranahara marmas are Vaksha (marmas of the chest), simant, Talahridaya, Kshipra, Indrabasti, Katiktaruna, Parshva sandhi, Brihati and Nitamba.

क्षिप्राणि विद्धमात्राणि घ्नन्ति कालान्तरेण च □

सु.शा.६/२१

तत्र पादस्यांगुष्ठांगुल्योर्मध्ये क्षिप्रं नाम मर्म तत्र विध्दस्याक्षेपकेण मरणं.....‖

सु.शा.६/३१

The marma known as Kshipra maram is situated between the great toe and the second toe of the foot. When this marma is injured, death occurs due to convulsions.

Kshipra marma is a snayu type of marma. It measures Ardhangula in Anguli pramana. It is also a Kalantara pranahara marma. According to the location as described here it can be located in first Intermetatarsal space. In this space two important anatomical structures are seen, first is Dorsal Metatarsal artery and a branch of the Deep Peroneal nerve going to big toe. In case of injury to this marma the death takes place due to convulsions. The convulsions may be toxic in nature. The convulsions are produced in the conditions like bleeding or in

tetanus bacilli infection. The immediate death generally happens in severe bleeding but in case of tetanus it takes place within few days. First dorsal metatarsal artery a branch of the dorsalis pedis artery can be taken as an anatomical structure which represents Kshipra marma.

क्षिप्राणि सद्यःप्राणहराण्यपि भवन्ति □

तेष्वपि कालान्तरप्राणहर मर्मेष्वपि तु क्षिप्राणि कदाचिदाशु □

अष्टांगसंग्रह

कालान्तरप्राणहराणि पक्षान्मासाद्वा तेष्वपि क्षिप्राणि कदाचिदाशु मारयन्ति □

सु.शा.६/३0

क्षिप्रेषु तत्र सतलेषु हतेषु रक्तं गच्छत्यतीव पवनश्च रूजं करोति □

एवं विनाशमुपयान्ति हि तत्र विद्धा वृक्षा इवायुधाविघातनिकृत्तमूलाः □

सु.शा.६/४२

In case of injury the Kshipra and talahridaya marmas of the palm and sole, there is excessive bleeding and the vayu produces severe pain. In case of injury to these marmas one dies just like a tree whose roots have cut by heavy instrument.

There has been a great discussion regarding the death caused by severe haemorrhage in cases of marmas. It has also been mentioned in Ashtanga Sangraha that haemorrhages due to any etiology on any place in the body, definitely becomes a cause of death. In Ashtanga Sangraha the symptoms are difficulty in breathing, depression, coma and convulsions preceded by haemorrhage, similar to the symptoms mentioned in modern surgery. In cases of Kshipra and Talahridaya marmas the blood vessels lie deeply hidden. Therefore bleeding in these areas is severe and it is very difficult to check it immediately.

क्षिप्रतलहृदय मर्मचिकित्सा

तस्मात्तयोरभि हतस्य तु पाणिपादं □

छेत्तव्यमाशु मणिवन्धनगुल्फदेशे □सु.शा.६/४३

Therefore in cases of injury to Kshipra and Talahridaya marmas the hand or foot should immediately be amputated above the manibandha (wrist) and gulph (ankle).

In diseases such as Padadaha, Padaharsha (tenderness / tingling in the soles), Chippa (whitlow), Visarpa (erysipelas), Vatashonita (gout), Vatakantaka (sprain ofthe ankle), Vicharchika (a skin disease) and Padadari (fissures of soles) etc., the vein situated two Angula (4 cm) above the Kshipra Marma should be punctured usingVrihimukha Shastra. As per the quotation Siravyadha is done in the said diseases 2 Angula above from Kshipra Marma. The anatomical location of vein that part is interpreted on available anatomical grounds. Usually Marma Sthanas are contraindicated for Siravyadha. Regarding "KSHIPRA" Marma is concerned gives a meaning of quick due to its immediate effect. It controls Rasavaha, Pranavaha, Avalambaka and heart.

TABLE SHOWING DETAILS OF KSHIPRA MARMA

No.	Name	Adhoshakhagata Kshipra marma	Urdwashakhagata Kshipra marma
1	**Sankhya**	2	2
2	**Type – According to Rachana Parinam Pramana**	Snayu Kalantarpranahara ½ anguli	Snayu Kalantarpranahara ½ anguli
3	**Site**	Situated in between the big toe and second toe.	Situated in between the thumb and index finger.
4	**Tissue involved anatomical structures**	Adductor hallicis bravis, lumbricalis muscles, deep peroneal nerve, dorsal metatarsal artery plantar arch and medial planter artery.	Flexor pollicis brevis, adductor pollicis, branches of Median nerve, dorsal metatarsal artery and superficial palmar arch supplying blood to the fingers.
5	**Sings if injured**	Injury may cause impairment of the function of the adduction and flexion of great toe. Damage to the artery may cause severe bleeding, haematoma inside the plantar apponeurosis and septic toxemia.	Injury may cause quick loss of function of adduction and flexion of thumb and severe bleeding from the palmar arch.

REVIEW OF PADADAHA

According to Vachaspatya the word Padadaha literally means burning sensation in the foot.

In ayurved Padadaha is not explained as separate disease but it is explained under Vatavyadhi. In Sushruta Samhita Padadaha is explained in Nidan sthana prathamoadyaya.

पित्तासृक्सहितोऽनिलः पादयोर्विशेषतश्चङ्क्रमणाद्दाहं कुर्यात् ।

पादयो कुर्यात् दाहं पित्तासृक्सहितोऽनिलः |

विशेषतश्चङ्क्रमणात् पाददाहं तमादिशेत् ||

सु. नि. १क्र८० मा. नि. २२क्र६२

While narrating about the disease Padadaha all the Acharya's Vagbhata, Madhavakara mentioned that specifically due to Chankramanadi that is travelling is the main hetus of the disease. Further on his commentary Acharya Dalhana specifies that chamkramana means travelling from one place to another place by any means.

Padadaha is a only symptom described in various Samhita's of the disease Padadaha. While narrating about the sysptoms of Padadaha on the Madhukosa commentory commentary on Madhava Nidhan, Acharya shree Vijayarakshita & Acharya Shrikanthadatta narrates about the symptoms3 of Padadaha that by writing about पादयोरितयदि विशेषतः चंक्रमत: means that the burning sensation of foot is increases or felt more while walking or on moving condition, but while in stationary position like, in lying down position as sleeping or in sitting position the intensity of this burning sensation is less.

On further its Hindi commentary Bhavarthabadhini, it is written that the Vata which is mixed with Pitta & Rakta cause burning sensation on feet. This burning sensation is felt more while walking or moving & is comparatively less

on relaxing position. The reason behind that is due to walking, there is friction on foot, which vitiates Vata & thus further makes derangements of Pitta & Rakta on foot, causing burning sensation, but in relaxing position, there is no or less vitiation of so the symptom may be felt less. This disease is known as Padadaha.

Acharya Vijayarakshita further mentioned about this & differentiates between the disease Vata-Rakta, that the absence of symptom i.e. discoloration of skin & other symptom found in the disease Vata-Rakta made it different from that disease.

While narrating about the disease Padadaha, all the Acharya's Sushruta, Vagbhata, Madhavakara narrates the same samprapti, that is Vata when in association with Pitta & Rakta, produce burning sensation in the foot(sole), especially who walks too much & then disease is known as Padadaha. Due to without Vata aggravation, this disease can't originate, so this disease comes under Vata vyadhi. Acharya Dalhana, while differentiating with Padaharsha narrates the case of Padadaha disease is caused by siramukhavruta Vayu & if siramukha gets vivrutta it cures automatically.

While explaining about disease Padadaha as a type of Vata vyadhi Acharya Madhavakara in madhava Nidana mentioned the aggravation of Vata,Vata gets associated with Pitta & Rakta & manifest burning sensation of foot. Acharya Madhavakara mentioned that in some Vata disease where there is Kapha & Pitta Dusta laxana seen in patients. But that disease can't take place with Vayu prakopa. Vata dosha is only responsible for taking them to other place and due to in such disease th& there is originator of disease is only & only Vayu, so Pitta & Kapha are anubundha here.

There are many factors which are responsible for the vimarga gamana of Pitta in this disease, in madhukosha tika commentary on Madhava Nidana,Acharya shri Vijayarakshita & Acharya shrikantha mentioned about Asayapkarsa Gati & explained when prakruta dosha which was on its normal state & property, was taken away anywhere else by aggravated Vata. This vitiated

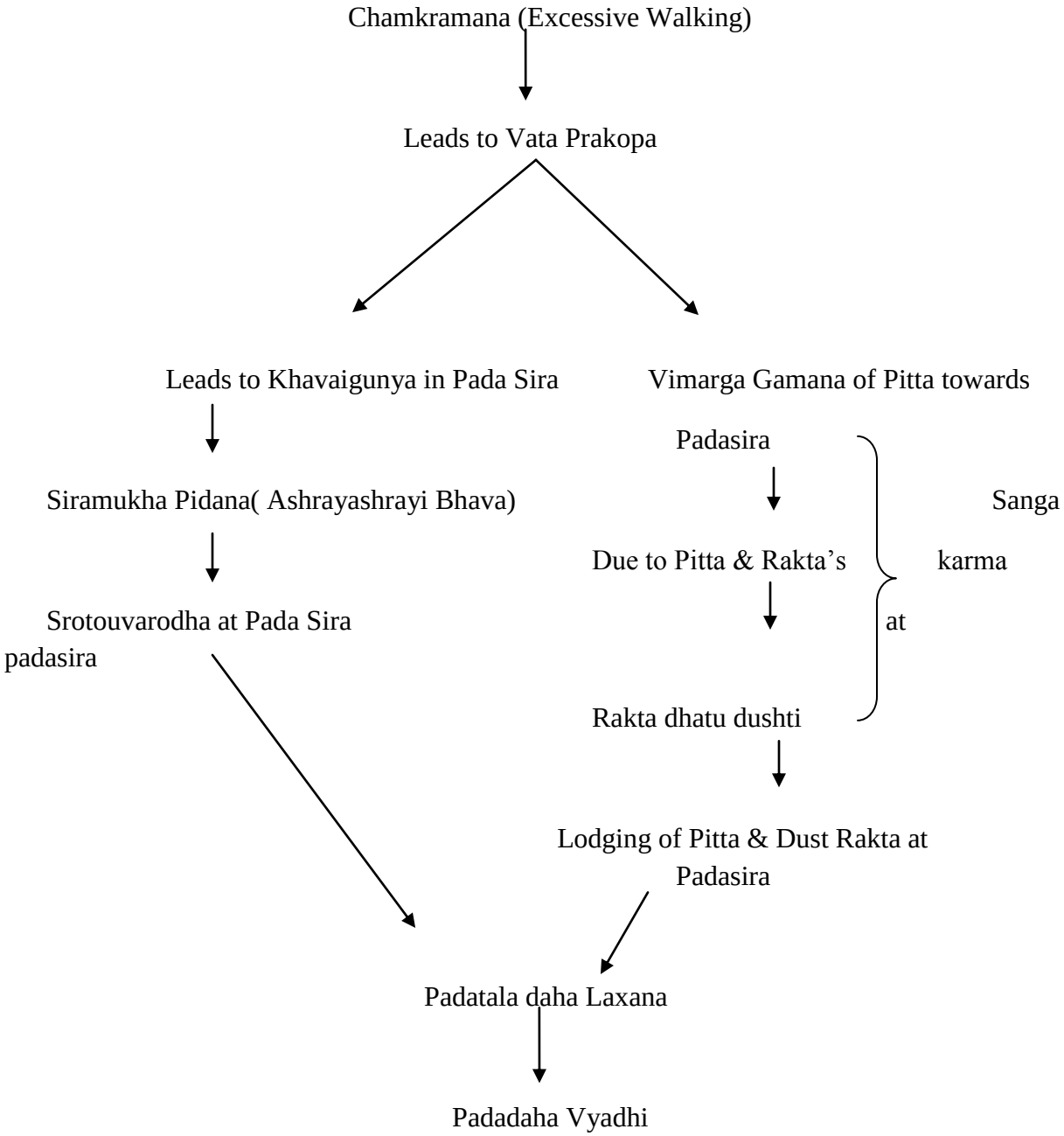
dosha became responsible for disease, when it is not in its original state, even if they may be on their normal state. This is called Asayapkarsa gati by aggravated Vata dosha.

Further on this happening Ashayopkarsha Gati in disease & how happened, Acharya Bhattar Harishchandra explained that when there is aggravation of Vata in the body,the vigunata of Vata is responsible for viation of Pitta from its normal place to anywhere else in the body. This is due to Vata prakopa there is already khavaigunya in pada, the vimarga gamana of this Pitta takes place at pada by ashayopkroha gati, this aggravated Vata.

In Sira, all the tridosha-Vata,Pitta & Kapha are already present disease & when there is increase in the quantity of Pitta due to coming of extra Pitta by vimarga gamana the cumulative quantity of Pitta is increased, so thus this Daha laxan is seen in the patients.

Some Acharya explained that Bhrajaka Pitta is present all over the body especially at sking & whenever there is aggravation of Vata, the aggravated Vata brings other dosha, Pitta which was in its normal state & its original place to some other place due to its karshana Guna,due to that, that particular place there is commutative increase in quantity of Pitta & shows Pittavriddhikara laxan so that the daha is seen without increase in Pitta there can't be symptom daha & dosha itself can't generate disease when they are in normal state.

Concept of Samprapti



Treatment

शीताः प्रदेहा रक्तस्थे विरको रक्तमोक्षणम् |

च.चि.२८क्र९२

Acharya charaka explained that when there is Vata prakopa in Rakta dhatu, cold Pralepa,Virechana & Raktamokshana procedure should be done.

उर्ध्व गुल्फस्य सक्थतो तथा □ष्टुकशीर्षके □

पाददाहे खुडे हर्षे विपाद्यां वातकण्टके □

चिप्पे च व्युडग्गुले विध्देदुपरि क्षिप्रमर्मणः □

अ.हृ.सू.२७क्र१६□१७

तत्र पाददाहपादहर्षावबाहुकचिप्पविसर्पवातशोणितवातकण्टकविचर्चिकापाददारीप्रभूतिषु

क्षिप्रमर्मण उपरिष्टाद् द्वयङ्गुले व्रीहिमुखेन सिरां विध्येत् □

सु.शा.८क्र२६

According to Acharya sushtruta in disease like Padadaha, Padaharsh-Avabahuka Chippa etc the sira vedhan should be done with vrihimukha instrument two fingers above the ksheeepra marma. Here Acharya mentioned the particular sira i.e. two fingers above the ksheeepra more which is to be punctured in Padadaha.

VENOUS SYSTEM

Veins are characterized by relatively thin wall and large capacitance compare to arteries. The structural plan of the wall is similar to that of other vessels, where the amount of muscle is considerably less than in arteries. In most veins, especially in the limbs, muscle is arranged circularly. Longitudinal muscle is present in iliac, portal, renal veins and in superior and inferior vena cava. On the contrary, muscular tissue is absent in placental veins, retinal veins; but these veins are consisting of endothelium supported by variable amount of connective tissue. Pressure within the venous system doesn't exceed 5 mm of Hg. As the vein grows larger it decreases up to zero. Because they contain small amount of muscle and usually vein have limited influence on blood flow. Due to any cause when there is sudden fall in blood pressure, there is reflex constriction in vein to compensate the blood loss and tend to maintain the venous return to the heart. Most veins have valves to prevent reflux of blood flow. When blood flow reverses, if the semi lunar valves cusps, not close properly, then blood fills in expanded valve of the vein giving rise to knotted appearance to the distended vein. Leg venous return is against gravity. Valves are of great importance. Blood is moved towards the heart by intermittent pressures produced by contractions of the surrounding muscles are absent in thorax and abdominal veins.

General Organization of Circulatory System:

Cells of the peripheral blood suspended in the plasma circulate throughout the body in blood vascular system. Interstitial fluid from peripheral tissue returns to the blood vascular system through the lymphatic system, which is preceding a channel for migration of leucocytes and absorption of certain nutrients from the gut. The cardiovascular system carries nutrients, oxygen, hormones throughout the body and disperses heat. As a result of pulse pressure which is a mechanical difference between systolic and diastolic pressure.

Blood circulates in a closed system where heart is the central pump, arteries carry the blood to the peripheral part, veins returns to the heart. From the

centre to the periphery, arteries increase in number by repeated bifurcation. The valves of arteries decrease in thickening towards periphery. Venules which return blood from periphery progressively increase in size. Arteries are usually deeply situated than vein. Overall blood from the heart to all parts of the body carries through a series of tubes. Smooth muscle is contractile where actin and myosin are organized in regular semilunar manner. These tubes are composed of smooth muscles. Smooth muscles typically found in tubular structure and hollow viscera, the actual arrangement of cells vary with tissue. Smooth muscle has no attachment structure to the fasiae, tendons etc. Blood supply of smooth muscle is extensive than striated muscles.

Composition of Vein:

Veins are composed of essentially three coats as that of arteries. But there are variations in their relative thickness. If arteries are to be distinguished from veins following reasons may be given

- The wall of a vein is very thin than the artery.

- The tunica media contains much collagen than arteries. The amounts of elastic tissues are much less.

- In arteries tunica media, usually thicker than the adventitia. In contrast the adventitia of veins is thicker than the media. In some large veins the adventitia contains a considerable amount of elastic and muscle fibres which run in a predominantly longitudinal direction. These fibres facilitate elongation and shortening of the vena cava with respiration.

- A clear distinction between the tunica intima, media and adventitia cannot be made out in small veins as all these layers consist predominantly of fibrous tissue. Muscle is conspicuous by its complete absence in venous spaces of erectile tissue, in veins of cancellous bone, dural venous sinuses, retinal veins and placental veins.

Microscopic Structure of Vein:

(I) Tunica Intima –

Endothelium The endothelium is a mono-layer extending continuously over the entire vascular tree. It is a key component of vessel wall playing major physiological roles. Endothelial cells regulate diffusion of substances and migration of cells out of and into the circulating blood, as these are in contact with blood stream, so influencing blood flow. Ex : in the brain, endothelial cells of small vessels actively transport substance like glucose into the brain parenchyma. In the process of 'fibrinolysis' or clot dissolution by secreting a tissue plasminogen activator by endothelial cells, and they have got phagocytic activity. Endothelial cells synthesize components of basal lamina. They proliferate to provide new cells during growth in size of blood vessel to replace the damaged cells. Angiogenesis is stimulated by endothelial production in response to locally low oxygen tension. It is important in wound healing and in growth of tumors.

So overall, all the blood vessels including vein are lined with endothelial cells. Cells are polygonal and elongated along the length of vessels. These endothelial cells are sensitive to alteration in blood pressure, blood flow and oxygen tension in the blood. They secrete various substances that can produce vasodilation by influencing the tone of the muscles in vessel wall. They produce factors which controls the coagulation of blood. Under normal condition clotting is inhibited, when required clotting is facilitated. Under influence of adverse stimuli [ex: cytokines it has been seen that T-lymphocytes produce cytokines and affect other cells. The function of the cytokines is to stimulate the production of blood cells. Apart from T-cells cytokines are also produced by monocytes, macrophages, endothelial cells. Some cytokines are identified as interlukins, granulocytes stimulating factors, stem cell factor,erythropoietin] endothelial cells undergo certain changes which facilitates passage of lymphocytes through the vessel wall. Ex: in acute inflammation, endothelium allows neutrophils to pass from blood into surrounding tissue. By influence of histamine (stimulated by antigen mast cells release histamine into tissue) endothelium becomes highly

permeable allowing proteins and fluid to diffuse into the tissue resulting too edema. The changes that they occur in endothelium described above are taking place very rapidly within fraction of minutes.

(II) Tunica Media:

It consists of concentric layers of circumferentially arranged smooth muscle cells, with variable amount of elastin and collagen. Smooth muscle forms most of the media of arteries and arterioles. A thin layer of smooth muscle also found in venules and veins. Smooth muscle cells synthesize and secrete elastin and collagen which bear directly on mechanical properties of vessels like distensibility cells support, elasticity, and rigidity. The muscle cells can be regarded as multifunctional mesenchymal cells. After damaged to the endothelium, muscle cells migrate into the intima and proliferate to reform the layer. In certain pathological conditions, muscles undergo fatty degeneration, or participate in formation of atheromatous plaque.

(III) **Tunica Adventitia:**

This layer is formed by general connective tissue varying in the thickness.

Vasa Vasorum:

Nourishment of tissue of vessel wall is provided by blood circulating vessels itself. Large vessels have own vasculae supply within adventitia, in the form of network of vessels called vasa vasorum. Vasa vasorum orginate from and and drains into adjacent vessels which are peripheral branches.

Developmental Anatomy of Blood Vessels:

The human yolk sac has little yolk to nourish the developing embryo, blood and blood vessel. Formation starts as early as 15-16 days in the mesoderm of the yolk sac, chorion, and body stalk. Blood vessels develop from isolated masses and cords of mesenchyma in the mesoderm called blood islands. Spaces soon appear in the islands and become the lumens of the blood vessels. Some of

the mesenchymal cells immediately around the spaces give rise to the endothelial lining of the blood vessels. Mesenchyme around the endothelium forms the tunis of the larger blood vessels. Growth and fusion of blood islands form an extensive network of blood vessels throughout the embryo.

Development of Veins:

The cardiovascular system is the first major system to function in the embryo. The primordial heart and vascular system appear in the middle of the third week of embryonic development. The heart starts to function at beginning of fourth week. This precocious heart development is necessary because the rapidly growing embryo can no longer satisfy its nutritional and oxygen requirement by diffusion alone .Consequently, there is a need for an efficient method of acquiring oxygen and nutrients from the maternal blood and disposing of carbon dioxide and waste products. Angiogenesis or blood vessel formation begins in the extra-embryogenic mesoderm of the yolk sac, connecting stalk, and chorion. Embryonic blood vessels begin to develop about two days later. The early formation of the cardiovascular system is correlated with the absence of a significant amount of yolk in oocyte and yolk sac and the consequent urgent need for blood vessels to bring oxygen and nourishment to the embryo from the maternal circulation through the placenta. At the end of the second week, embryonic nutrition is obtained from the maternal blood by diffusion through the extra embryonic coelom and yolk sac. During the 3rd week and primordial uteroplacental circulation develops. Primordial blood vessels cannot be distinguished structurally as arteries or veins, but are named according to their future fates and relationship to the heart. The formation of the embryonic vascular system involves two processes vasculogenesis and angiogenesis. Blood vessel formation in the embryo and extraembryonic membranes during the 3rd week may be summarized as follows:

- Mesenchymal cells differentiate into endothelial cells precursor

-Angioblasts (vessel-forming cells), which aggregate to form isolated angiogenic cell clusters-blood islands.

- Small arteries appear within the blood islands by confluence of intercellular clefts.

- Angioblasts flatten to form endothelial cells that arrange themselves around the cavities in the blood island to form the endothelium.

- These endothelium lined cavities soon fuse to form networks of endothelial channels. (vasculogenesis).

- Vessels sprout into adjacent areas by endothelial budding and fuse with other vessels (angiogenesis).

Blood cells develop from the endothelial cells of vessels (hemangioblasts) as they develop on the yolk sac and allantois at end of the third week. Blood formation does not begin in the embryo until the 5th week. It occurs first in the various parts of the embryonic mesenchyme, chiefly the liver and later in the spleen, bone marrow and lymph nodes. Fetal and adult erythrocytes are derived from the different hematopoietic progenitor cells. The mesenchymal cells surrounding the primordial endothelial blood cells differentiate into the muscular and connective tissue elements of the vessels. The earliest sign of the heart is appearance of pair endothelial strands -angioblastic cords in the cardiogenic mesoderm during the 3rd week. These cords canalize to form heart tubes, which fuse to form the tubular heart late in the 3rd week. The heart begins to beat at 23rd day. An inductive influence from the anterior endoderm stimulates early formation of the heart. The development of heart and blood vessels is controlled by a cascade of regulatory genes and signaling molecules.

Three paired veins drain into the tubular heart of a four-week embryo –

- “Vitelline veins” return poorly oxygenated blood from the yolk sac.

- “Umbilical veins” carry oxygenated blood from the primordial placenta.

- “Common cardial veins” return poorly oxygenated blood from the body of the embryo.

The vitelline veins follow the yolk stalk into the embryo. The yolk stalk is then arrow tube connecting the yolk sac with the midgut. After passing through the septum transversum, the vitelline veins enter the venous end of the heart - the “sinusvenosus”. As the liver primordium grows into the septum transversum the hepatic cords anastomose around pre-existing endothelium lined spaces. These spaces, the primordial of the “hepatic sinusoids”, later become linked to the vitelline veins. The “hepatic veins” form from the remains of the right vitelline vein in the region of the developing liver. The portal vein develops from an anastomosis network formed by the vitelline veins around the duodenum. The ‘umbilical veins’ run on each side of the liver and carry well oxygenated blood from the placenta to the sinus venosus. As the liver develops, the umbilical veins lose their connection with the heart and empty into liver. The right umbilical vein disappears during the seventh week, leaving the left umbilical veins as the only vessel carrying well-oxygenated blood from the placenta to the embryo.

Transformation of the umbilical veins may be summarized as follows;

- The right umbilical vein and the caudal part of the left umbilical vein between the liver and sinus venosus degenerate.

- The persistent caudal part of the left umbilical vein becomes the umbilical vein, which carries all the blood from the placenta to embryo.

- A large venous shunt - the ductus venosus develops within the liver and connects the umbilical vein with the inferior vena cava.

The cardinal veins constitute the main venous drainage system of the embryo. The anterior and posterior cardinal veins drain cranial and caudal part of the embryo, respectively. The anterior and posterior cardinal veins join the common cardinal veins, which enter the sinus venosus. During the 8th week of embryonic development, the anterior cardinal vein becomes connected by an

anastomosis which shunts blood from the left to the right anterior cardinal vein. This anastomotic shunt becomes the left brachio-cephalic vein when caudal part of the left anterior cardinal vein degenerates. The superior vena cava forms from the right anterior cardinal vein andthe right common cardinal vein.

The posterior cardinal veins develop primarily as the vessels of them esocephalic (interim kidneys) and largely disappears with this transitory kidneys. The only adult derivatives of the posterior cardinal veins are the root of the azygos vein and the common iliac veins. The subcardinal and supracardinal veins gradually replace and supplement the posterior cardinal veins. The sub-cardinal vein appears first. They are connected with each other through the subcardinal anastomosis andwith the posterior cardinal veins through the nephric sinusoids. The sub-cardinal veins form the stem of the left renal vein, the suprarenal veins, the gonadal veins and segment of IVC. The supracardinal veins are the last pair of vessels to develop. They become disrupted in the region of the kidneys. Cranial to this, they become united by an anastomosis i.e. represented in the adult by the azygos and hemi-azygos veins. Caudal to the kidneys, the left supracardinal veins degenerates, but the right supracardinal veins becomes the inferior part of the IVC.

Development of Superior Vena Cava:

The precardinal veins enlarge as the head and brain develop. They are further raugmented by the subclavian veins from the upper limb buds, and so become the chief tributaries of the common cardinal veins, which gradually assume an almost vertical position in association with the descent of the heart into the thorax. That part of the original precardinal vein rostral to the subclavian is now the internal jugular vein, and their confluence is the brachio-cephalic vein of each side. The right and left common cardinal veins are originally of the same diameter. By the development of a large /transverse connection, the left brachio-cephalic vein carries blood across from the left to the right. The part of the original right precardinal vein between the junction of the two brachio-cephalic and azygos veins forms the upper part of the superior vena cava, the caudal part of

the latter vessel is formed by the right common cardinal vein. Caudal to the transverse branching of the left brachio-cephalic the left precardinal and left common cardinal veins largely atrophy, the former constituting the terminal part of the left superior intercostal vein; while the latter is represented by the ligament of the left vena cava and the oblique vein of the left atrium. The remainder of the left superior intercostal is developed from the cranial end of the post cardinal vein and drains the second, third, on occasion the fourth intercostal veins. The oblique vein passes downwards across the back of the left atrium to open into the coronary sinus which, as already indicated, represents the persistent left horn of the sinus venosus. Right and left superior venae cavae are present in some animal and occasionally inmankind.

Development of Inferior Vena Cava:

The inferior vena cava (IVC) forms during a series of changes in the primordial veins of the trunk that occur as blood, returning from the caudal part of the embryo, is shifted from the left to the right side of the body. The IVC is composed off our main segments

- A hepatic segment derived from the hepatic vein (proximal part of right vitelline vein) and hepatic sinusoids.

- A prerenal segment derived from the right subcardinal vein.

- A renal segment derived from the subcardinal-supracardinal anastomosis.

- A postrenal segment derived from the right supracardinal vein.

The early postcardinal veins communicate across the midline via an inter-post-cardinal anastomosis between the iliac veins, and become the major part of the definitive left common iliac vein. It diverts an increasing volume of blood into the right longitudinal veins, which accounts for the ultimate disappearance of the

most of those on the left. The supracardinal veins receive the larger venous drainage of the growing body wall. The right supracardinal vein persists and forms the greater part of the post renal segment of the IVC. The continuity of the vessel is maintained by the persistence of the anastomosis of between the right supracardinal and right subcardinal vein in the renal collar.

In summary, therefore, the inferior vena cava is formed from below upwards by the confluence of common iliac veins; short segment of the right post cardinal vein, the post cardinal-supracardinal anastomosis, part of the right supra-cardinal vein, anew anastomotic channel of double origin, the hepatic segment of the inferior vena cava; and the cardiac termination of the right vitelline hepatocardiac vein.

PHYSIOLOGY OF VEINS

Usually physiology explains the physical and chemical factors that are responsible for the origin, development and progression of life. The human physiology is concerned; we are concerned with specific characteristics and mechanisms of the human body that make it a living being. The basic unit of the body is cell. Each type of cell is specially adopted to perform functions. About sixty percent of the adult human body fluid inside the cell is called intra-cellular fluid. About one third is in space outside the cell is called extracellular fluid. This extracellular fluid is in constant motion throughout the body. It is rapidly transported in circulating blood and mixed between blood and tissue fluid by diffusion. In extracellular fluid nutrients needed by the cells, for maintenance of their life. Extracellular fluid is called internal environment of the body. The extracellular fluid cells those are capable of living, growing, performing need proper concentration of O_2, glucose, ions, amino acids, fatty acids and other nutrients. Extracellular fluid contains sodium, chloride, bicarbonate, oxygen, glucose, fatty acids, and amino acids. It also contains carbon dioxide, which is transported from cells to the lungs. The intracellular fluid differs completely. It contains Potassium, phosphate, Magnesium etc.

Homeostasis:

The term homeostasis is maintenance of constant internal environment so that all the tissues of the body perform their function to maintain constant conditions; where lungs provide oxygen to the extracellular fluid, kidneys, maintain ion concentration, GIT provides nutrition. So collectively all together is homeostasis.

Usually extracellular fluid is transported through all parts of body in two stages:

One is movement of blood in and around circulatory system, movement of fluid between the capillaries and cells [Guyton Fig. 1.1]. As the blood passes through the capillaries there is continuous exchange of extracellular fluid that

occurs between plasma of portion of blood and interstitial fluid, which fills intercellular spaces [Fig. 1.2] Note that capillaries are porous, so that large amount of fluid and its dissolved constituents can diffuse back between blood and tissue spaces. This process of diffusion is caused by kinetic motion of molecules in both plasma and interstitial fluid. 68

Thus the extracellular fluid is continuingly being mixed, there by maintaining almost homeostasis of the body. When blood passes throughout the body, it passes through lungs also, blood picks up oxygen in alveoli needed by cells. The oxygen diffuses by molecular motion through this membrane into the blood. In the same way water and ions diffuse through tissue capillaries. A large portion of blood pumped by the heart passes through the walls of the GI tract organs where different dissolved nutrients are absorbed from the ingested food into the extracellular fluid. All the substances absorbed from GIT not utilized from the cells. The liver changes the chemical composition of these substances to more usable from to all tissues. At the sometime blood picks up O_2 from the lungs, CO_2 released blood into alveoli, so that the CO_2 is most abundant end product of metabolism. Passage of blood through kidneys removes most of the substances like CO_2, urea, uric acid, excess ions and water. The human body is literally thousands of control systems in it. But the most of significant of these is genetic controlled system. Many others control system operate by nervous and humoural regulations (chemical). Oxygen is one the major substance required for the chemical reactions in the cells. It is god gift that body has special control mechanism to maintain exact constant O_2 concentration in the extracellular fluid. It is principally depending on chemically characteristics of hemoglobin present in RBCs. Hemoglobin combines with O_2 as blood passes through the lungs. Then blood passes through the capillaries. Because of its strong chemical affinity, it doesn’t release the oxygen to tissue fluid, if too much oxygen is already there. If oxygen concentration is too low there sufficient oxygen is released for adequate oxygen concentration. Like this carbon dioxide concentration in the extracellular fluid is also essential. This is end product of the oxidative reaction in cells. If all carbon dioxide formed in the cells accumulate in tissue fluids, exciting respiratory

centres causing to breath deeply and rapidly. So several systems like baro-receptor systems, and chemical receptor systems are responsible for it.

An Overview of Circulation:

The function of circulation is to serve the needs of the tissue such as nutrients, O_2, hormones and also to transport waste products away, in general to maintain an appropriate environment in all the tissue fluids for survival and function of the cells. Sometimes it is difficult to understand how blood flow is controlled according to tissue needs.

The circulation is divided into

(1) Systemic circulation and

(2) Pulmonary circulation.

Systemic circulation supplies all the tissues of the body except the lungs with blood flow, it is called peripheral circulation. The vascular system in each separate tissue of the body has its own special characteristics; some general principles of vascular system apply in all the parts of the body. The function of arteries is to transport blood under high pressure to the tissues. As arteries have strong vascular walls, so blood flows rapidly in arteries. The arterioles are the last small branches of the arterioles system and they act as control valves through which blood is released into the capillaries. The arteriole has the strong muscular wall, capable of closing and dilating, having capability of vastly altering blood flow to the capillaries in response to the need of the tissues. The function of the capillaries is to exchange the fluid nutrients, fluids, electrolytes, hormones and other substances between the blood and interstitial fluid. For this purpose the capillary walls are very thin and permeable to small molecule substances. The venules collect blood from the capillaries, which gradually coalesce into progressive larger veins. The veins function as conduits for transport of blood from tissues back to the heart and serve as the major reservoir of the blood,

because the pressure in venous system is very low. The venous walls are thin. Depending upon the needs of the body they also contract and expound.

Volumes of Blood in Different parts of Body:

64 % in veins, 13% in arteries, 7% in arterioles, capillaries, 7 % in heart and 9 % in pulmonary vessels.

Cross Sectional Areas of the Blood Flow:

- Aorta 2.5 cm^2
- Small Arteries 20 cm^2
- Arteries 40 cm^2
- Capillaries 2500 cm^2
- Venuoles 250 cm^2
- Small veins 80 cm^2
- Venae cavae 8 cm^2

Cross-sectional areas of vein are much larger than the arteries which explain large storage of blood in venous system. The same volume of blood flows through each segment of circulation each minute. The velocity of blood flow is inversely proportional to its cross sectional area.

Basic Theory of Circulatory Function:

When tissues are active, they need more blood flow. Heart normally cannot increase its cardiac output more than 4-7 times. Therefore, it is not possible to increase blood flow everywhere in the body. When a particular tissue demands increased flow. Instead, micro-vessel of each tissue is monitoring the tissue needs, such as availability of oxygen and other nutrients and the accumulation of waste products. And these in turn control local blood flow to the level of tissue need. The cardiac output is controlled mainly by the sum of all

local tissue flows. When blood flows through a tissue it immediately returns by the way of veins to the heart. The heart responds to this increased inflow by pumping all the blood immediately back to the arteries.

Vascular Distensibility:

The valuable characteristic of blood vessels is that they are distensible. Ex: when a pressure in arterioles is increased this dilates, the arterioles. Therefore, decreases their resistance. The result is increased blood flow, not only because of increased pressure, but also because of decreased resistance. The distensibility of arteries and veins are different. Anatomically the walls of arteries are far stronger than those of veins. Consequently, veins are eight times distensible as the arteries. That means, a given in rise of pressure causes about eight times much extra blood to fill a vein as to fill an artery.

Effect of Sympathetic Stimulation or Inhibition on Blood Vessels:

Large changes are observed in blood flow caused by increased or decreased sympathetic stimulation. Because inhibitions of sympathetic stimulation greatly dilate the vessels and can increase the blood flow. Conversely, strong sympathetic stimulation can constrict the vessels so much that blood flow can be decreased as low as zero. Regarding volume, pressure, relations are concerned, sympathetic stimulation increases vascular smooth muscle tone, where it increases pressure at each volume of arteries or veins; whereas sympathetic inhibition decreases the pressure at each volume. For an instance, increase in vascular tone throughout systemic circulation often causes large volume of blood to shift into the heart, which is a reason for increased heart pumping, sympathetic controls of vascular capacity is especially important during loss of blood [hemorrhage]. Enhancement of sympathetic tone of vessels, especially of veins reduces, the vessel sizes, so that the circulation continues to operate almost normally even when 25% of total blood volume has been lost.

Veins and their Functions:

For years, the veins have been considered to be nothing more than passageways, for flow of blood into the heart. But it is becoming apparent that they perform other special functions that are necessary to the operation of circulation. They are capable of constricting and enlarging there by storing small or large quantity of blood and making this blood available when it is required by the circulation. Vein can also propel blood forward by means of which called venous pump, which will regulate even cardiac output. To understand various functions of vein is necessary to know the pressures in the vein and how they are regulated. Blood from all systemic veins flows into right atrium of the heart; the pressure in the right atrium is called central venous pressure. Anything that affects right atrial pressure definitely affects venous pressure everywhere in the body. Right atrial pressure is regulated by balance between the ability of the heart to pump blood out of the right atrium and tendency for blood to flow from the peripheral vessels back into the right atrium. The normal right atrial pressure is about zero mm of Hg which is equal to the atmospheric pressure of the body. It can rise to 20-30 mm of Hg under abnormal condition, where there is serious heart failure and massive transmission of blood. Large veins have little resistance to the blood flow, when they are distended. The large veins usually offer considerable resistance to the blood flow, because of this the pressure in the peripheral veins is 4-7 mm of Hg. that is greater than the right atrial pressure. This central pressure is regulated by right atrial pressure, peripheral venous pressure, pressure of abdominal vein and venous pressure of the leg.

Blood Reservoir and Function of Veins:

Venous system serves as blood reservoir for the circulation when blood is lost from the body and arterial pressure begins to fall, pressure reflexes are elicited from carotid sinuses and other pressure sensitive areas of circulation. These in turn send sympathetic nerve signals to the veins causing them to constrict. So even after as much as 20 % of total blood volume has been lost. The

circulatory system often functions almost normally because of reservoir function of veins.

Specific Blood Reservoirs:

Certain portions of circulatory system are extended to some other portions called blood reservoirs. These include spleen, liver, large abdominal veins, venous plexus, beneath the skin altogether contribute more than thousand ml of blood.

The Spleen as a Reservoir for Storing Red Blood Cells:

The spleen has two separate areas for storing blood; the venous sinuses and pulp. Small vessels flow directly into the venous sinuses, and the sinuses can swell the same as any other part of the venous system and store whole blood. In the splenic pulp, the capillaries are so permeable that whole blood oozes through the capillary walls into a trabecular mesh forming the red pulp. The red cells are trapped by the trabeculae, where as the plasma returns into the venous sinuses and then into general circulation. As a consequence, the red pulp of the spleen is as special reservoir of extra red blood cells that are expelled into the general circulation when the sympathetic nervous system is excited and contracts the spleen or its vessels. In the lower animals, this extra-storage of red blood cells is much greater than in human, but in even in the human, possibly much as 50 millions of concentrated red blood cells can be released into the circulation, raising the hematocrit 1-2 %. In other areas of the splenic pulp are islands of white blood cells, which collectively are called the white pulp. Here lymphoid cells are manufactured similar to those manufactured in the lymph nodes. They are part of the body's immune system. Blood Cleansing Function of the Spleen - Removal of Old Cells: Blood passing through the splenic pulp before it enters the sinuses undergoes thorough squeezing. Therefore, it is to be expected that fragile red blood cells would not withstand the trauma. For this reason, many of the red blood cells destroyed in the body have their final demise in the spleen. After the

cells rupture, the released hemoglobin and the cells stroma are ingested by the reticuloendothelial cells of the spleen.

Reticulo-endothelial Cells of the Spleen:

The pulp of the spleen contains many large phagocyte reticulo-endothelial cells and the venous sinuses are lined with similar cells. These cells act as a cleansing system for the blood, acting in concert with a similar system in the venous sinuses of the liver. When the blood is invaded by infectious agents, the reticulo-endothelial cells of the spleen rapidly remove debris, bacteria, parasites, and so forth. Also, in many infectious processes, the spleen enlarges in the same manner the lymph glands enlarge and then performs its cleansing function even more avidly.

MICROCIRCULATION

The most purposeful function of the circulation occurs by the transport of nutrients to the tissues and removal of cellular excreta. The small arterioles control the blood flow to each tissue area. The most instances controls its own blood flow its relation to its needs. The capillaries are extremely thin structures with walls of a single layer of highly permeable endothelial cells. Here interchange of nutrients of cellular excreta occurs between the tissues and circulating blood. The peripheral circulation of the whole body has about 10 billion capillary with a total surface area estimated to be 500-700 mm of sq m. It is very essential to know the factors that they affect the transfer of fluid through capillary walls between circulating blood and interstitial fluid.

Anatomy of Microcirculation:

The microcirculation of each part of the body is specifically serve special needs of that part. In general arteries become small enough to be called arterioles, which generally have internal diameter less than 20 micrometers. The microcirculation of each organ organized specifically to serve organ special needs. As arteries become small enough to become arteries then blood enters from

arteriole to capillaries and leaves by the way of venule, the venules are considerably larger than the arterioles and have a much weak muscular coat. Blood causally doesn't flow continuously through the capillaries. Instead it flows intermittently turning on and off every few seconds. The most important factor found thus far to affect the degree of opening closing off meta arterioles and pre-capillaries sphincter is the concentration of oxygen in tissues. When the rate of oxygen use is great the intermittent periods of blood flow occur more often there by allowing the blood by carrying increased qualities of oxygen to the tissues. There is an average rate of blood flow through tissue capillary bed and an average rate of transfer of substances between the blood of the capillaries and the surrounding interstitial fluid. Billions of individual capillaries are responding to the local condition to the tissue.

Exchange of Nutrients Blood and Interstitial Fluid:

Diffusion through the capillary membrane: Substance is transferred between plasma and interstitial fluid is by diffusion. Blood transverses the capillary, tremendous number of water molecules and dissolved particles move through the capillary wall. Diffusion results from thermal motion of water molecules and dissolved substances in the fluid. The different molecules and ions moving first into one direction and then in another direction, bouncing randomly in every direction. Lipid soluble substances can diffuse directly through the cell walls of capillary endothelium. If a substance is lipid soluble it can diffuse directly through the cell membrane of capillary without having to go through the pores. The substances include oxygen carbon dioxide as great as the rate at which plasma itself flows linearly along the capillary. That is, the water of the plasma is exchanged with water of the interstitial fluid 80 times before the plasma can go the entire distance through the capillary.

Effect of Molecular Size of Passage through Pores:

The width of capillary intercellular cleft-pores, 6-7 nanometers, is about 20 times the diameter of the water molecule, which is the smallest molecule that

normally passes through the capillary pores. On the other hand, the diameters of plasma protein molecules are slightly greater than the width of the pores. Other substances such as sodium ions, chloride ions, glucose, and urea, have intermediate diameters. Therefore, the permeability of the capillary pores for different substances varies according to their molecular diameters. The capillaries in different tissues have extreme differences in their permeabilities. For instance, the membrane of the liver capillary sinusoids is so permeable that even plasma proteins pass freely through these walls almost as easily as water and other substances. These substances can permeate all areas of the capillary membrane, the rate of transport through the capillary membrane are many times the rates for most lipid-insoluble substances such as sodium ions and glucose. Water-Soluble Substances Diffuse Only through Intercellular "Pores" in the Capillary Membrane: Many substances needed by the tissues are soluble in water but cannot pass through the lipid membranes of the endothelial cells, such substances include water molecules themselves, sodium ions, chloride ions, and glucose. Despite the fact that not more than 1/1000 of the surface area of the capillaries are represented by the intercellular cleft between the endothelial cells, the velocity of thermal molecular in the cleft is so great that even this small area is sufficient to allow tremendous diffusion of water and water soluble substances through these cleft-pores. To give one an idea of the rapidity with which these substances diffuse, the rate at which water molecules diffuse through the capillary membrane is about 80 times. Also the permeability of the renal glomerulae and muscle permeabilities for protein are about the same. The degrees of capillary permeability are greater in liver, for instance, to transfer tremendous amounts of nutrients between the blood and the liver parenchymal cells and the kidneys to allow filtration of large quantities of fluid for the formation of urine.

Effect of Concentration of Difference on Net Rate of Diffusion through the Capillary Membrane:

The 'net' rate of diffusion of a substance through any membrane is proportional to the concentration difference between the two sides of the

membrane. That is, the greater the difference between the concentrations of any given substance on the two sides of the capillary membrane, the greater will be the net movement of the substance in one direction through the membrane. Thus, the concentration of oxygen in the blood is normally greater than that in the interstitial fluid. Therefore, large quantities of oxygen normally move from the blood toward the tissues. Conversely, the concentration of carbon dioxide is greater in the tissues than in the blood which causes carbon dioxide to move into the blood and to be carried away from the tissues. The rates of diffusion through the capillary membranes of most nutritionally important substances are so great that only slight concentration differences suffice to cause more than adequate transport between the plasma and interstitial fluid. For instance, the concentration of oxygen in the interstitial fluid immediately outside the capillary is probably no more than 1 % less than the concentration in the plasma of blood, and yet this 1 % difference causes enough oxygen to move from the blood into the interstitial spaces to provide all the oxygen required for tissue metabolism.

The Proteins in the Plasma and Interstitial Fluid mainly determine the Plasma and Interstitial Fluid Volume:

The pressure in the capillaries tends to force fluid and it's dissolved substances through the capillary pores into the interstitial spaces. In contrast, osmotic pressure caused by the plasma protein tends to cause fluid movement by osmosis from the interstitial spaces into the blood; this osmotic pressure prevents significant loss of fluid volume from the blood into the interstitial spaces. Also important is the lymphatic system, which returns back to the circulation the small amounts of protein that do leak into the interstitial spaces.

The Interstitium and Interstitial Fluid:

The about one sixth of the body consists of spaces between cells, which collectively are called the interstitium. The fluid in these spaces is the interstitial fluid. The structure of the interstitium has two major types of solid structures: (1) Collagen fibre bundles and proteoglycan filaments. The collagen fiber bundles

extend long distances in the interstitium. They are extremely strong and therefore provide most of the tensional strength of the tissues. The proteoglycan filaments, on the other hand, are extremely thin, coiled molecules composed by about 98 % hyaluronic acid and 2 % protein. These molecules are so thin that they can never be seen with a light microscope and are difficult to demonstrate even with the electronic microscope. Nevertheless, they form a mat of very fine reticular filaments aptly described as "brush pile."

'Gel' in the Interstitium - the fluid in the interstitium is derived by filtration and diffusion from the capillaries. It contains the almost same constituents as plasma except for much lower concentration of proteins because proteins do not pass outward through the pores of capillaries with ease. The interstitial fluid is mainly entrapped in the minute spaces among the proteoglycan filaments and the fluid present within them has characteristics of 'get'. Therefore is called as tissue gel. Because of the large number of proteoglycan filaments, it is difficult for fluid to flow through tissue 'gel', but still then it diffuses through the gel only diffusion through cell occurs 99 % rapidly rather than free fluid. So the diffusion allows rapid transport of electrolyte nutrients, oxygen, carbon dioxide and cellular excreta.

Interstitial Pressure:

As the body is surrounded by tight encasement, such as cranial vault around the brain, strong fibrous capsule around the kidney, fibrous sheaths around the muscles, sclera around the eye, the interstitial fluid pressure is positive in these areas. One should remember that pressure exerted on skin is atmospheric pressure and normal interstitial fluid pressure is usually negative, as per previously heard concept, interstitial fluid pressure is always positive. There is general belief that true interstitial fluid pressure in the tissues is slightly less than atmospheric pressure. Lymphatic system is the basic cause of negative pressure.

Lymphatic system plays its role in determining interstitial fluid pressure. Lymphatic system is scavenger, which removes the excess of fluid, protein, debris

etc and other matter from the tissue spaces. When fluid enters the lymphatic capillaries, any movement of the tissue propels the lymph forward through the lymphatic system, eventually emptying back into the circulation. In this way, any time any free fluid accumulates in the tissue, it is simply pumped away as a consequence of tissue movement, when the amount of fluid leaking from the blood capillaries is slight, as it true for most tissues, research evidence suggests that actually pump a slight intermittent negative pressure that gives an average negatively in the loose tissue. “Plasma Colloid Osmotic Pressure” - Proteins in the Plasma Cause Colloid Osmotic Pressure: The proteins are the only dissolved substances in the plasma and interstitial fluid, much of these are soon removed from the interstitial spaces by way of the lymph vessels. Therefore, the concentration of protein in the plasma averages about three times as much as that in most interstitial fluid; 7.3 gm/dl in the plasma versus 2-3 gm/dl in the interstitial fluid. Only those molecules or ions that fail to pass through the pores of semi-permeable membrane exert osmotic pressure. Because the proteins are the only dissolved constituents that do not readily penetrate the pores of the capillary membrane. It is the dissolved proteins of the plasma and interstitial fluids that are responsible for the osmotic pressure at the capillary membrane. To distinguish this osmotic pressure from that which occurs at the cell membrane, it is called either colloid osmotic pressure or on cotic pressure. The term “colloid” osmotic pressure is derived from the fact that a protein solution resembles a colloidal solution despite the fact that it is actually a true molecular solution.

Exchange of Fluid volume through the Capillary Membrane:

Now that the different factors affecting fluid movement through the capillary membrane have been discussed, the average capillary pressure at the arterial ends of the capillaries is 15-25 mm of Hg greater than at the venous ends. Because of this difference, fluid “filters” out of the capillaries at their arterial ends, and at their venous ends, fluid is reabsorbed back into the capillaries. Thus a small amount of fluid actually “flows” through the tissues from the arterial ends

of the capillaries to the venous ends. The dynamics of this flow are as follows: Analysis of the Forces Causing Filtration at the Arterial End of the Capillary: The approximate average forces operative at the arterial end of the capillary that cause movement through the capillary membrane are shown as follow:

VEINS OF THE LOWER EXTREMITIES

Development of Vessels in the Lower Limb

The axial artery of the lower limb arises from the dorsal root of the umbilical artery and courses along the dorsal surface of the thigh knee and leg. Below the knee it lies between the tibia and popliteus, and in the leg it lies between the crural interossoeus membrane and tibialis posterior. It gives off a perforating artery that traverses the sinal tarsus to form a dorsal network and ends distally in a plantar network. The femoral artery passes along the ventral surface of the thigh, opening a new channel to the lower limb. It arises from a capillary plexus that is connected proximally with the femoral branches of the external iliac artery and distally with the axis artery. At the proximal border of popliteus the axis artery splits into primitive posterior tibial and peroneal branches: these run distally on the dorsal surface of popliteus and tibialis posterior to gain the sole of the foot. At the distal border of popliteus the axis artery gives off a perforating branch that passes ventrally between the tibia and the fibula and then courses to the dorsum of the foot, forming the anterior tibial artery and dorsalis pedis artery. The primitive peroneal artery communicates with the axis artery at the distal border of popliteus and in its course in the leg.

The femoral artery gradually increases in size. Coincidentally, most of the axis artery disappears; however, proximal to its communication with the femoral artery, the root of the axis artery persists as the inferior gluteal artery and the arteria comitans nerviischiadici.

The proximal parts of the primitive posterior tibial and peroneal arteries fuse: they remain separate distally. Ultimately, much of the primitive peroneal artery disappears; however, a part of the axis artery is incorporated in the permanent peroneal artery.

In the lower limb the preaxial vein becomes the long saphenous vein, which drains into the femoral vein at the saphenous opening. The postaxial vein becomes the short saphenous vein, which passes deep and joins the popliteal vein.

Veins of the Lower Limb

The veins of the lower limb can be subdivided, like those of the upper limb, into superficial and deep groups. The superficial veins are subcutaneous and lie in the superficial fascia; the deep veins accompany the major arteries. Both groups have valves, which are more numerous in the deep veins and also more numerous than in the veins of the upper limb. Venous plexuses occur within and between some of the lower limb muscles.

The principal named superficial veins are the long and short saphenous veins. Their numerous tributaries are mainly unnamed.

Deep veins of the lower limbs accompany the arteries and their branches. Plantar digital veins arise from plexuses in the plantar regions of the toes, connect with dorsal digital veins and unite four plantar meta-tarsal veins. These run in the intermetatarsal spaces and connect by perforating veins with dorsal veins then continue to form a day plantar arterial arch. From this arch, medial and lateral plantar veins run near the corresponding arteries. They communicate with the long and short saphenous veins before forming the posterior tibial veins behind medial malleolus.

The posterior tibial veins accompany the posterior tibial artery. They receive veins from the calf muscles, especially the venous plexus in soleus, and connect with the superficial veins and with the peroneal veins. The latter, running with their artery, receive branches from soleus and superficial veins.

The anterior tibial veins are continuations of venae comintantes of the dorsalis pedis artery. They leave the extensor region between the tibia and fibula,

pass through the proximal end of the interossoeus membrane, and unite with the posterior tibial veins to form the popliteal vein at the distal border of popliteus.

Considerable of the venous drainage is of great importance because in the lower limb venous blood has to ascend against gravity. This is aided by a number of local factors, the failure of which gives rise to varicose veins. The veins of lower limb may be classified into three groups

I. Superficial Veins
II. Deep Veins
III. Perforating Veins

I. Superficial Veins: They include the great and small saphenous veins and their tributaries. They lie in the superficial fascia, on the surface of the deep surface. They are thick walled because of the presence of smooth muscle and some fibrous and elastic tissues in their walls.

II. Deep Veins: These are the anterior and posterior tibial, peroneal, popliteal, & femoral veins and their tributaries. They accompany the arteries and are supported by powerful surrounding muscles. The valves are more numerous in deep veins than in superficial veins. They are more efficient channels than the superficial veins because of the driving force of muscular contraction.

III. Perforating Veins: They connect the superficial with the deep veins. Their valves permit only one way flow of blood, from the superficial to the deep veins. There are about five perforators along the great saphenous vein, and one perforator along the small saphenous vein.

Superficial Veins of Lower limb

(1) The dorsal venous arch lies on the dorsum of the foot over the proximal part of the meta-tarsal bones. It receives four dorsal meta-tarsal veins each of which is formed by the union of two dorsal digital veins

(2) The great or long saphenous vein is formed by the union of the medial end of the dorsal venous arch with the medial marginal vein which drains the medial side of the medial surface of tibia obliquely, and runs along its medial border to reach the back of the knee. The saphenous nerve runs in front of the great saphenous vein.

(3) The small or short saphenous vein is formed by the union of the lateral end of the dorsal venous arch with lateral marginal vein, draining the lateral side of the little toe. It passes upwards behind the lateral malleolus to reach the back of the leg. The sural nerve accompanies the small saphenous vein.

Both saphenous veins are connected to the deep veins through the perforating veins.

Great or Long Saphenous Vein

Saphes $\rightarrow$ Easily seen.

The saphenous vein can be easily seen in the leg. Venous drainage acquires importance as blood has to flow up against the gravity. The long saphenous vain, is the largest and longest superficial vein of the lower limb. It starts on the dorsum of the foot from the medial of the dorsal venous arch, and runs upwards in front of the medial malleolus along the medial side of the leg, and behind the knee. In the thigh, it inclines forwards to reach the saphenous opening where it pierces the cribriform fascia and opens into the femoral vein.

In its course through the thigh the long saphenous vein is accompanied by the branches of the medial femoral cutaneous nerve. Before piercing the cribriform fascia, it receives three named tributaries corresponding to the 3 cutaneous arteries and also many unnamed tributaries.

It contains about 10-15 valves which prevent back flow of the venous blood, which tends to occur because of gravity. One valve is always present at the saphenous femoral junction. Incompetence of these valves makes the vein dilated and tortuous leading to varicose vein.

In almost its entire extent the vein lies in superficial veins, but it has many connections with the deep veins, especially in the leg. The veins are also connected to the deeps veins of the limb by perforating veins. There are three medial perforators just above the ankle, one perforator just below the knee and another one in the region of the adductor canal. The perforating veins are also provided with valves which permit flow of blood only from the superficial to deep vein.

Tributaries

At the ankle the long saphenous vein drains the sole by medial marginal veins. In the leg it often connects with the short saphenous vein and with deep veins via perforating veins. Just distal to the knee it usually receives three large tributaries from the front of the leg, from the tibial malleolar region and from the calf. The tributary draining the tibial malleolar region is formed delicate veins overt the medial malleolus and then ascends the medial aspect of the calf as the posterior arch vein.

It connects with posterior tibial venae comintantes by a series of perforating veins. These are usually three equally spaced between the medial malleolus and the mid calf. More than three such perforators are uncommon and an arch vein perforators above mid calf is only very rarely found.

Above the posterior crural arch vein, perforating veins join the long saphenous

vein, or one of its main tributaries at the two main sites. The first at a level in the upper calf indicated by its name, the tibial tubercle. Perforator; the second is in the lower / intermediate third of the thigh where it perforates the deep fascial roof of the subsartorial canal to join the femoral vein.

In the thigh the long saphenous vein receives many tributaries. Some open independently; whilst others converge to form large named channels that frequently pass forwards the basal half of the femoral triangle before joining the long saphenous near its termination. These may be grouped as follows: one or more large postero- medial tributaries, one or more large antero-medial tributaries, four or more peri- inguinal veins. The postero-medial vein of the thigh, large and sometimes double, drains a large superficial region indicated by its name. It has radiological and surgical significance. One of its lower radicles is often continuous with short saphenous vein. The postero-medial vein is sometimes named the accessory saphenous vein; through some restrict the term accessory to a lower, postero-medial tributary when two are present. Another large vessel, the antero-lateral vein of the thigh usually commences from an anterior network of veins in the distal thigh and crosses the apex and distal half of the femoral triangle to reach the long saphenous vein. As the latter traverses the saphenous opening, it is joined by the superficial epigastric, superficial circumflex iliac and superficial external pudendal veins. Their mode of union varies. Superficial epiagastric and circumflex iliac veins drain the inferior abdominal wall, the latter also receiving tributaries from the proximo-lateral region of thigh. The long saphenous vein is often harvested for grafts used both in peripheral and coronary arterial surgery.

Surface Marking of long Saphenous Vein

It can be marked by joining the following points, although it is easily visible in living subjects:

(a) First point on the dorsum of foot at the medial end of the dorsal venous arch

(b) Second point on the anterior surface of the medial malleolus

(c) Third point on the medial border of the tibia at the junction of the upper two thirds and lower one third of the leg

(d) Fourth point at the adductor tubercle

(e) 5th point just below the centre of the saphenous opening.

Its formation is on the dorsum of the foot, its course along the entire length of the lower limb and its termination into femoral vein. It contains about 10-20 valves. There is one valve that lies just before the vein pierces the cribriform fascia and another at its termination into the femoral vein.

Short Saphenous Vein

The short saphenous vein starts on the lateral side of the foot and ascends up on the back of the leg to end in the popliteal vein. The vein is formed on the dorsum of the foot by the union of the lateral end of the dorsal venous arch with the lateral marginal vein. In lower third of the calf it ascends lateral to the calcaneal tendon, lying on the deep fascia and covered only by superficial fascia and skin. In the leg it ascends lateral to the tendocalcaneus, and then along the middle line of the calf, to the lower part of the popliteal fossa. Here it pierces the deep fascia and opens into the popliteal vein. It drains the lateral border of the foot, the heel and the back of the leg. It is connected with the great saphenous and with deep veins.

Tributaries

The short saphenous vein connects with deep veins on the dorsum of the foot, receives many cutaneous tributaries in the leg, and sends several communicating branches proximally and medially to join the long saphenous vein. Sometimes a communicating branch ascends medially to the accessory saphenous vein. This may be the main continuation of the short saphenous vein. In the leg, the short saphenous vein lies near the sural nerve, it has 7-13 valves

one near its termination. Its mode of ending is variable, it may join the long saphenous vein in the proximal thigh or it may bifurcate, one branch joining the long saphenous, the other the popliteal or deep posterior femoral veins. Sometimes, it ends distal to the knee in the long saphenous or sural muscular vein.

Surface Marking

It can be marked by joining the following points, although this vein is also easily visible in its lower part:

(a) A point on the dorsum of the foot at the lateral end of the dorsal venous arch

(b) Second point behind the lateral malleolus.

(c) Third point just lateral to the tendocalcaneus above the lateral malleolus.

(d) Fourth point at the centre of the popliteal fossa.

Its formation is on the dorsum of the foot, course along the back of the leg, and termination into the popliteal vein.

Just before piercing the popliteal fascia, it may give a communicating branch to the accessory saphenous vein. Sometimes, the whole of the small saphenous vein opens into the great saphenous vein through the accessory saphenous vein. Occasionally, the small saphenous vein ends below the knee either in the great saphenous vein, or in the deep muscular veins of the leg.

Perforating Veins

As already mentioned, they connect the superficial with the deep veins. There are classified as follows:

Indirect Perforating Veins

Indirect perforating veins connect the superficial veins with the deep veins

through the muscular veins.

Direct Perforating Veins

Direct perforating veins connect the superficial veins directly with deep veins. The great and small saphenous veins are the large direct perforators.

(a) *In the thigh:* the adductor canal perforator connects the great saphenous vein with the femoral vein in the lower part of the adductor canal.

(b) *Below the knee:* one perforator connects the great saphenous vein or the posterior arch vein with the posterior tibial vein.

(c) *In the leg:* (i) a lateral perforator is present at the junction of the middle and lower third of the leg. It connects the small saphenous vein or one of its tributaries with peroneal vein. Medially, there are three perforators which connect the posterior arch vein with the posterior tibial vein.

(d) The upper medial perforator lies at the junction of the middle and lower thirds of the leg.

(e) The middle medial perforator lies above the medial malleolus.

(f) The lower medial perforator lies posteroinferior to the medial malleolus.

Deep Veins of Lower Limb

Posterior Tibial Veins

The posterior tibial veins accompany the posterior tibial artery. They receive tributaries from the calf muscle and connections from the superficial veins and the peroneal veins. Posterior tibial vein is formed by the union of the medial and lateral plantar veins posterior to the medial malleolus.

Anterior Tibial Veins

The anterior tibial vein is the superior continuation of the dorsalis pedis vein in the foot. It extends between the tibia and fibula and unites with the posterior tibial to form the popliteal vein at the distal border of the popliteus.

Popliteal Vein

It begins at the lower border of the popliteus by the union of veins accompanying the anterior and posterior tibial arteries, and posterior tibial arteries. It is medial to the popliteal artery in the lower part of the fossa; posterior to the artery in the middle and postero-lateral to it in the upper part of the fossa. The vein continues as the femoral vein at the opening in the adductors magnus.

The popliteal vein receives -

(1) Small saphenous vein and

(2) The vein corresponding to the branches of the popliteal artery.

Profunda Femoris Vein

The profunda femoris vein lies anterior to its artery, and has tributaries corresponding to the branches of the artery. Through these tributaries it connects distally with the popliteal and proximally with the inferior gluteal veins. It sometimes drains medial and lateral circumflex femoral veins. It has a valve just before it terminates.

Femoral Vein

The femoral vein accompanies its artery beginning at the adductor opening, as the continuation of the popliteal vein, and ending posterior to the inguinal ligament as the external iliac vein. In the distal adductor canal, it is postero-lateral to the femoral artery, more proximally in the canal, and in the distal femoral triangle, it is posterior to it, proximally, at the base of the triangle, it is medial. The vein occupies the middle compartment of the femoral sheath, between the femoral artery and canal, fat in the latter allowing expansion of the

vein. It has many muscular tributaries; 4-12 cm distal the inguinal ligament the profunda femoris vein joins it posteriorly and then the long saphenous vein, which enters anteriorly. Veins accompanying the superficial epigastric, superficial circumflex iliac and external pudendal arteries join the long saphenous vein before it enters the saphenous opening. Lateral and medial circumflex femoris veins are usually tributaries of the femoral. There are usually four or five valves in the femoral vein. The two most constant are just the distal to the entry of the profunda femoris and near the inguinal ligament.

Deep and Superficial Venous Systems of the Foot

Plantar digital veins arise from the plexuses in the plantar regions of the toes, connecting with dorsal digital veins and uniting into four plantar metatarsal veins. The latter run in the intermetatarsal spaces and connect by perforating veins with dorsal veins, then continue to form the deep plantar venous arch that accompanies the plantar arterial arch. From this venous arch, medial and lateral plantar veins run near the corresponding arteries and after communicating with the great and small saphenous veins, from the posterior tibial veins behind the medial malleolus.The principal named superficial veins are the great and small saphenous. Their numerous tributaries are mostly unnamed. Dorsal digital veins receive rami from the plantar digital veins in the clefts between the toes and then join to form dorsal metacarpal veins, which are united across the proximal parts of the metatarsal bones in a dorsal venous arch. Proximal to this arch, an irregular dorsal venous network receives tributaries from deep veins and is continuous, proximally with a venous network in the leg. At each side of the foot, this network connects with medial and lateral marginal veins, which are both formed mainly by veins from more superficial parts of the sole. In the sole, superficial veins form a plantar cutaneous arch across the roots of the toes and also drain into the medial and lateral marginal veins. Proximal to the plantar arch there is a plantar cutaneous venous plexus, especially dense in the fat of the heel. It connects with the plantar cutaneous venous arch and other deep veins, but drains mainly into the marginal

veins. The veins of the sole are an important part of the lower limb 'venous pump' system aiding return of the blood up the limb. Intermittent to enhance this flow and so reduce the risk of deep vein thrombosis during periods of increased risk, e.g. after surgery.

Valves in Superficial veins of the lower extremity

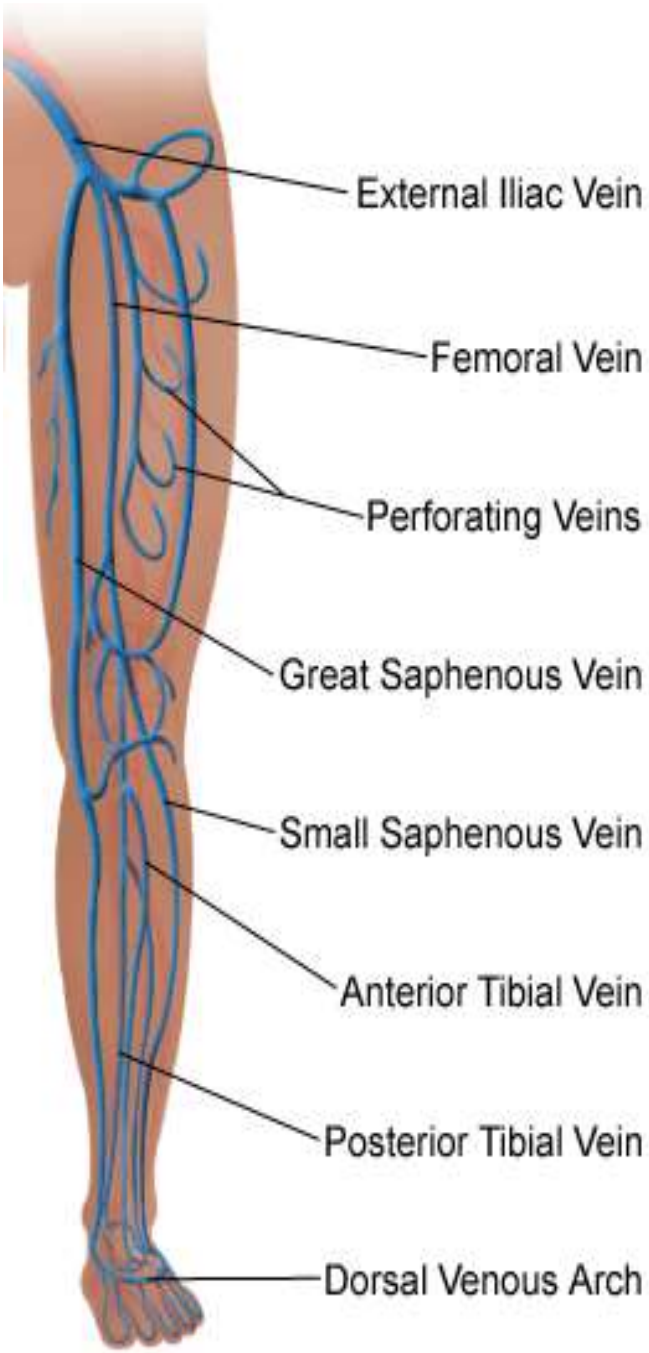
The great saphenous vein has 10 to 12 valves, which are more numerous in the leg than in the thigh. These valves are usually located just inferior to the perforating veins. The perforating veins also have valves. Venous valves are cusps of endothelium with cup like valvular sinuses that fill from above. When they are full, the valve cusps occlude the lumen of the vein, thereby preventing reflux of blood distally, making flow unidirectional. The valvular mechanism also breaks the column of blood in the saphenous vein into shorter segments reducing back pressure. Both effects make it easier further the musculovenous pump to overcome the force of gravity to return the blood to the heart. As it ascends in the leg and thigh, the great saphenous vein receives numerous tributaries and communicates in several locations with the small saphenous vein. Tributaries from the medial and posterior aspects of the thigh frequently unite to form an accessory saphenous vein. When present, this vein becomes the main communication between the great and small saphenous veins. Also, fairly large vessels - the lateral and anterior cutaneous veins--arise from networks of veins in the inferior part of the thigh and enter the great saphenous vein superiorly, just before it enters the femoral vein. Near its termination, the great saphenous vein also receives the superficial circumflex iliac, superficial epigastric, and external pudendal veins. The small saphenous vein arises on the lateral side of the foot from the union of the dorsal vein of the small (little) toe with the dorsal venous arch. The small saphenous vein:

- Ascends posterior to the lateral malleolus as a continuation of the lateral marginal vein
- Passes along the lateral border of the calcaneal tendon
- Inclines to the midline of the fibula and penetrates the deep fascia

• Ascends between the heads of the gastrocnemius muscle
• Empties into the popliteal vein in the popliteal fossa.

Although many tributaries are received by the saphenous veins, their diameter remains remarkably uniform as they ascend the limb. This is possible because the blood they receive is continuously shunted from these superficial veins in the subcutaneous tissue to the deep veins by means of the many perforating veins. The perforating veins penetrate the deep fascia close to their origin from the superficial veins and contain valves that, when functioning normally, only allow blood to flow from the superficial veins to the deep veins. The perforating veins pass through the deep fascia at an oblique angle so that when muscles contract and the pressure increases inside the deep fascia, the perforating veins are compressed. This also prevents blood from flowing from the deep to the superficial veins. This pattern of venous blood flow from superficial to deep is important for proper venous return from the lower limb because it enables muscular contractions to propel blood toward the heart against the pull of gravity (musculovenous pump) Valves in superficial veins of the lower extremity usually are located near to the termination of major tributaries. Some valves are well developed with marked sinusoid dilation at their base; others are more delicate in their structure. In the great saphenous there are about six valves, with more valves located below than above the knee. A nearly constant valve of great saphenous vein is at 2–3 cm distal to its confluence with the femoral vein. Valves in the short saphenous vein are closer to each other than in the great saphenous. Valves in communicating branches between the short saphenous vein and great saphenous are oriented to direct blood from the small to the great saphenous vein. Similar to superficial veins, deep veins have more valves in the calf than in the thigh. Tibial veins are densely packed with valves, whereas there are only one or two valves in the popliteal vein. In the femoral vein there are three to five valves, with one of them located just distal to the junction of the deep femoral vein. There is usually one valve in the common femoral vein. Major

perforating veins have one to three valves, all located below the level of the fascia, that direct flow toward the deep veins. Small perforating veins are usually valve less. Perforating veins of the foot are without any valves or with valves that direct flow towards the superficial veins


External Iliac Vein
Femoral Vein
Perforating Veins
Great Saphenous Vein
Small Saphenous Vein
Anterior Tibial Vein
Posterior Tibial Vein
Dorsal Venous Arch

Materials and Method

The study was carried out in 3 parts

1. Conceptual
2. Cadaveric
3. Observations

1. Conceptual

Concept of Sira was reviewed from Ayurvedic classics, modern literature & the related work done by others.

Material

a) Different Ayurvedic texts i.e. Bruhattrayaa, Laghuttrayee as well as Kashyapa Samhita. Bruhattrayee especially sushruta samhita with commentary Nibanda Sangraha by Dalhana & Dr. G B Ghanekar.
b) The study of research papers, scientific magazines help to clear the concepts of sira
c) Modern literature related to vein-reviewed from Gray's anatomy by Henry Gray, Principles of anatomy & physiology by Tortora, medical physiology by Gayton Hall. These modern books which help to clear the structure & functions of sira.

2. Cadaveric study

The cadaveric study was carried out by dissecting 8 cadavers according modern method.

Material

The following materials were taken for cadaveric study

a) Cadavers
b) Cadaver preservation tank
c) Cunningham's manual of practical anatomy volume –I
d) Instruments
e) Digital Camera

a) Cadavers:

For the cadaveric study, eight cadavers were dissected in Rachana Sharir department.

The embalmed cadavers were obtained by Medical College.

b) Cadaver Preservation Tank

Hydraulic cadaver preservation tank was used for preservation storage of the cadavers. Five body capacity of preservation tank was used. This tank was containing formalin & water in a ratio of 2:1. The embalmed cadavers were preserved in this tank.

c) Cunningham's Manual of practical anatomy volume-I

It was used as guidelines for dissection of lower extremity. The dissection methods given in the books were followed to observe the various systems of lower extremity.

d) Instruments

Following instruments were used for dissection of lower extremity

Scalpel – (B.P., Handle, blade), Tooth forceps, plain forceps, scissor

e) Digital Camera

Digital camera was used to take snaps of dissected structure i.e. venous system of lower extremity. During dissection, the venous system of lower extremity was observed and images were captured with camera.

Methods

Embalming procedure in cadavers was done by gravitation method. In five bodies, the common carotid arteries were used for embalming procedure and in three bodies; the femoral arteries were used embalming technique. Embalming procedure done by Medical College.

Eight bodies were dissected & studied. Removing skin, dissection has been started with the instructions stated in practical book and dissection of lower extremity carried out. Incision made as given & first removed the skin, then superficial fascia &

deep fascia containing superficial vessels. The vessels kept in position only fascia was removed. All the superficial vessels of the lower extremity have been observed during dissection. Most of the veins observed by naked eye & studied. Observations & study of deep veins vedhya and avedhya siras was done during dissection.

3. Observational study

Study sub-clinical type which had been conducted in 200 diagnosed patients of Padadaha.

Materials

I. Scalp vein set no. 24
II. Kidney tray
III. Measuring flask
IV. B.P. Apparatus

Methods

The observational study was carried out in hospital.

Total 200 patients suffering from Padadaha were selected randomly. Counseling of the patient was done. Proper plan of treatment was made by physician & the internal medicine-Arogyavardhini churna 1gm (twice a day with koshna jala), Gandarva Haritaki 2gm (night with koshna jala) was prescribed by Physician. The sira for vedhan was selected randomly according to group. The siravedhan was done in Panchakarma department.

A case record form with written informed consent prepared for collecting data.

Patients were put under two groups.

Group A

In this group, 100 patients which were receiving both medicines and padagata siravedha two fingers above Kshipra marma as mentioned by Acharya Sushruta in same disease had been observed.

Group B

In this group, 100 patients which were receiving both medicine and other padagata siravedha except the sira two fingers above Kshipra marma had been observed.

This group was divided to see the exact role of particular padagata sira mentioned in particular diseases.

For doing the siravyadha procedure firstly patient was asked to sit or lie down comfortably & then a ligature or tourniquet was tied at the calf region just below the knee Here B.P. apparatus was used as tourniquet. This helped to make the vein more prominent. Then in group A, 100 patients, the dorsal venous arch which was 2 fingers above the Kshipra marma was selected & in other group B, 100 patients, the other veins short saphenous, medial marginal vein and lateral marginal were selected for siravedha. The vein which was more prominent preferred for venesection.

After selecting the vein, the part is cleared with spirit & the vein was elevated. The scalp vein was inserted into the vein & let the blood flow in kidney tray which was kept on the floor.

Before electing the vein for siravedha the vein, skin condition was observed and B.P. was taken.

During bleeding colour, consistency of blood was observed. 50 to 200 ml blood was removed at at a time according to patient condition and blood flow stoppage automatically in some patients. The quantity of removed blood varies from patient to patient. This procedure was repeated after 15 days.

During siravyadha procedure, no any complications were observed. At the end of siravyadha procedure scalp vein set which was introduced at the place of the foot was removed, cleaned and proper bandaging was done with the help of sterilized cotton swab, gauze piece & band-aid.

The B.P. was observed before & after siravedha.

The patient advised to take rest for some time and then let him out.

Selection Criteria:-

Inclusion criteria

1) Patients of both genders.
2) Patients age in between 18-70 yrs.
3) Patients suffering from Padadaha receiving both internal medicine & sira vedha

Exclusion Criteria

1) Patients age below 18 yrs & above 70 yrs
2) Patients suffering from diabetes & other bleeding disorders were excluded from the study.

Assessment Criteria

1. Detailed history & physical examinations of patient having Padadaha was done with the prepared case record proforma.
2. All observations noted & subjected to statistical analysis & patients relief symptoms were recorded by scale
3. Patients were initially assessed when he/she firstly came to the hospital & first assessment was done after the siravedha procedure and finally after 15th day.
4. Obtained results in relief of the symptom were graded as follows.

Complete relief: +++ (70-90%)
Moderate relief: ++ (50-70%)
Mild relief: + (30-50%)
No relief: 0 (10-30%)

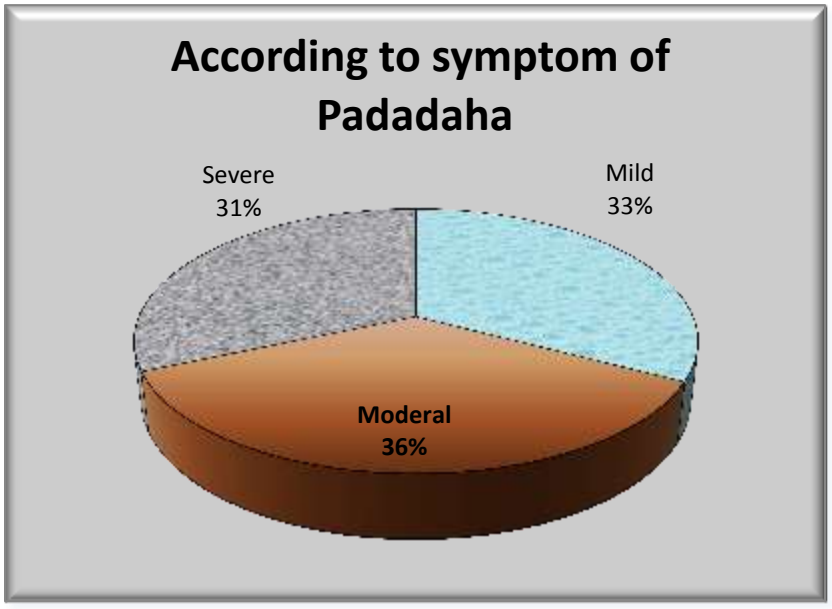
It is compared to the condition prior to the treatment.

OBSERVATIONS

Total number of 200 patients, 165 patients are examined and selected for Siravedha. 35 patients are dropped out from the study. The observational study was carried on total 165 patients having Padadaha 83 patients received treatment of Siravedha at 2 angula above the Kshipra marma as mentioned by Acharya Sushrita & 82 patients were received siravedhan of other adhoshakhagata siras which are not mentioned by Acharya Sushruta in Padadaha.

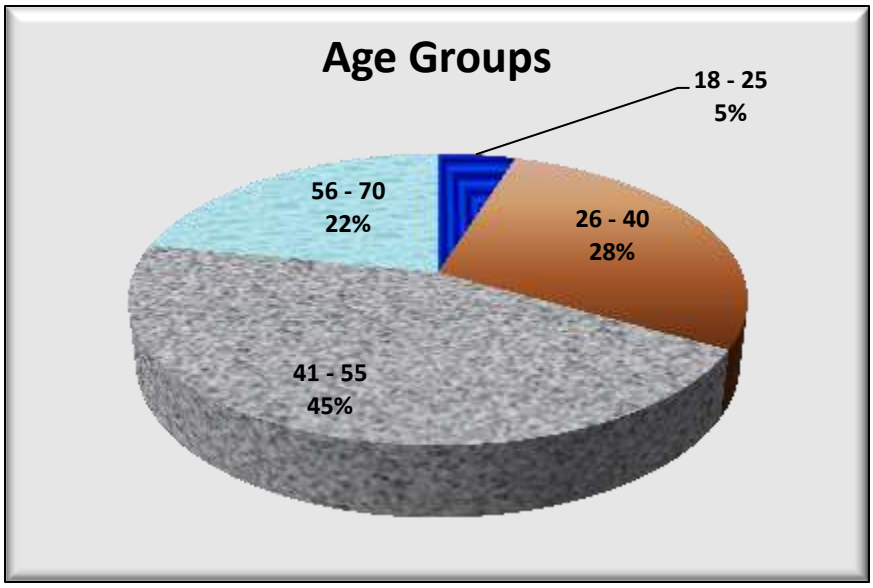
The influence of Prakruti, Sharir bala, age and gender are grouped as severe, mild & moderate Padadaha.

1. According to symptom of Padadaha



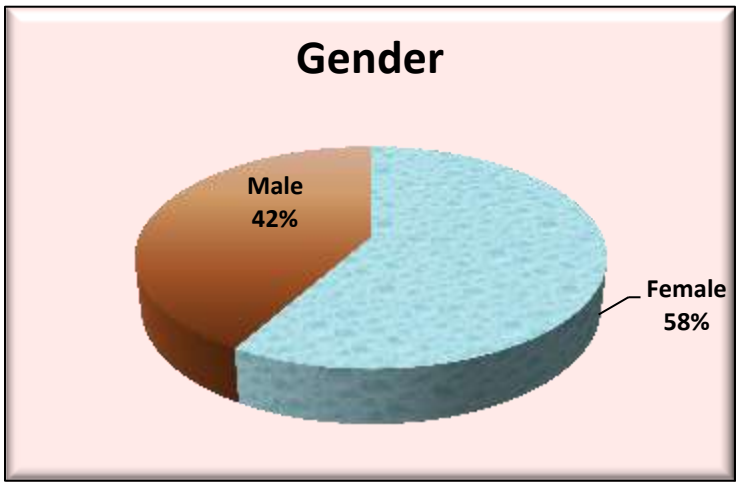
The patents were having severe daha in pada at night found to be 32% and moderate daha were of 35%.

2. According to Age Group



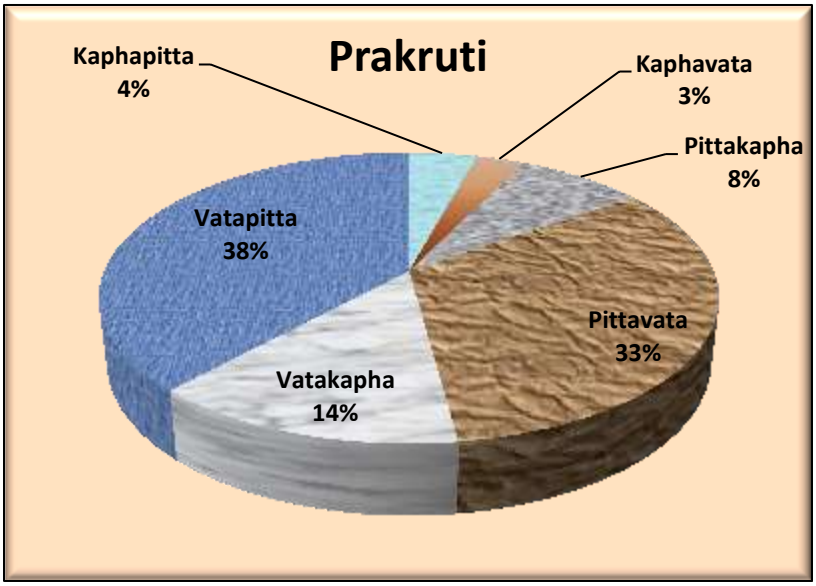
According to age group, the incidence of severe Padadaha is found higher in age group 41-55 years as compared to other age groups. It is recorded as 45%. This proves the prominent effect occupation, prakruti, hereditary.

3. According to Gender



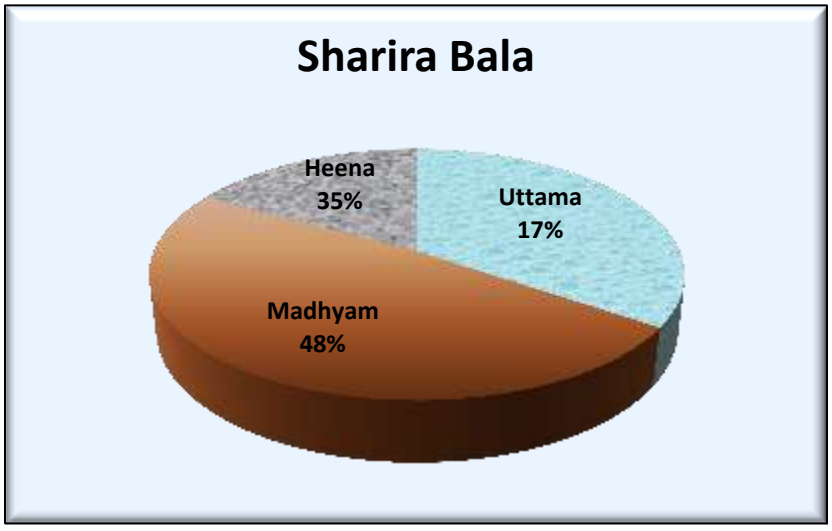
According to gender maximum patients who were suffering from disease Padadaha were female & that was 58%.

4. According to Prakruti



Maximum percentage of patients suffering were having vata pittaj prakruti that was 38% & the 2nd highest percentage was of pitta vataj prakruti that was 33%.

5. According to sharir bala



According to sharir bala 48% patients having madhayama sharir bala and 35% having Heena sharir bala.

6. The adhoshakhagata siras and skin condition

A. Sira Examination

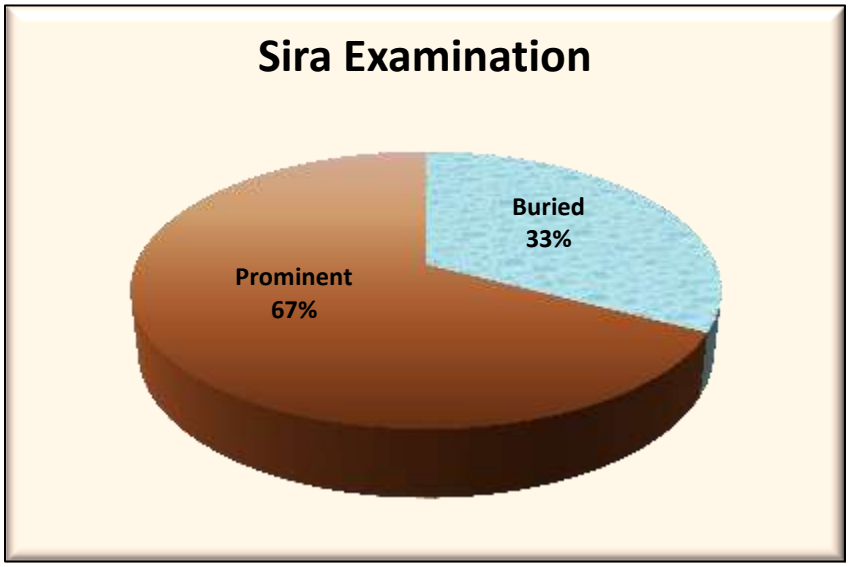
I

Sira	Number of Patients	Percentage
Thick	72	43.64
Thin	93	56.36
Total	**165**	**100**

II

Sira	Number of Patients	Percentage
Under tension	70	42.42
Relaxed	45	27.27
Total	**165**	**100**

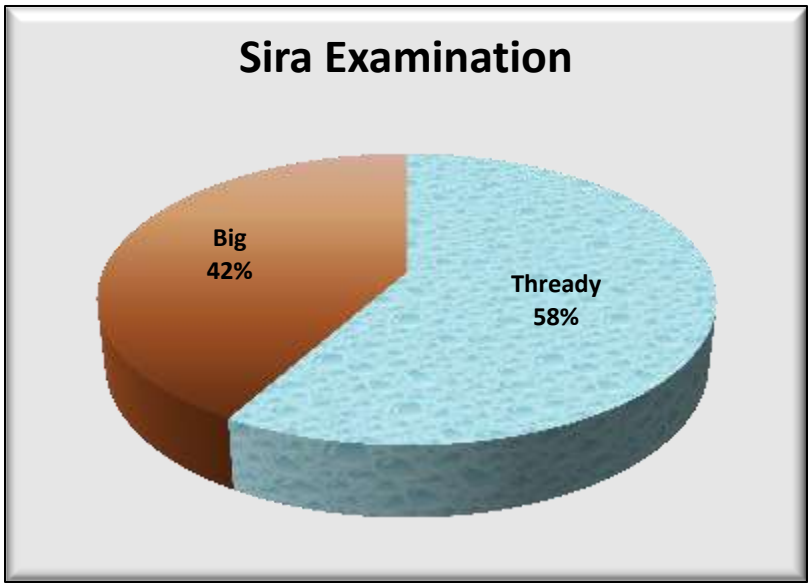
III



IV

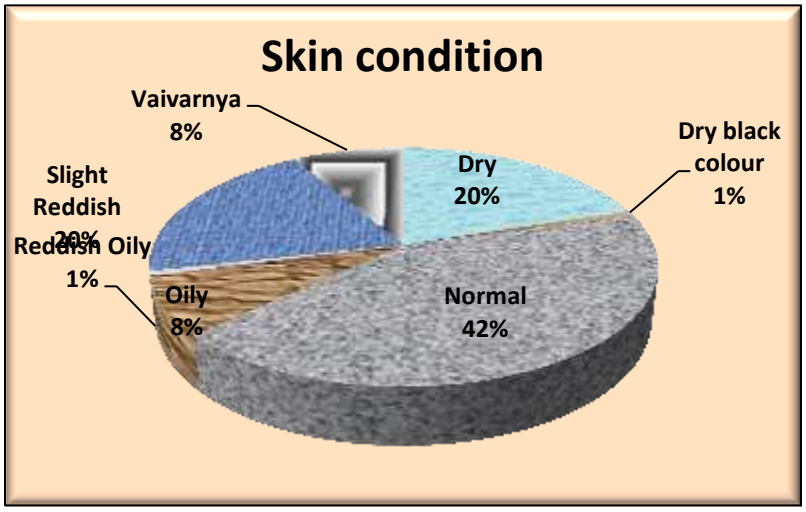
Sira	Number of Patients	Percentage, %
Slippery	76	46.06
Fixed	89	53.94
Total	**165**	**100**

V.



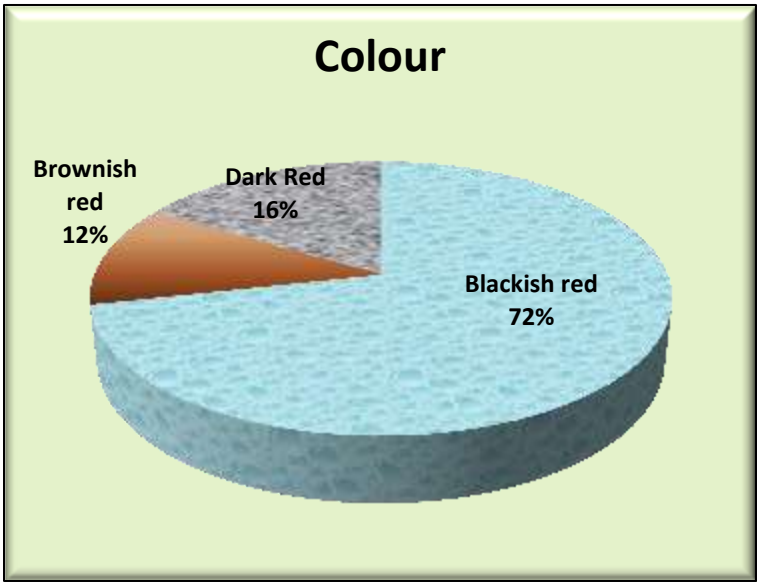
The patients were suffering from Padadaha were having Thin (56.36%), under tension (42%), Prominent (67%), Fixed (53%) and Thready (58%) siras of adhoshakha.

B. Skin Condition

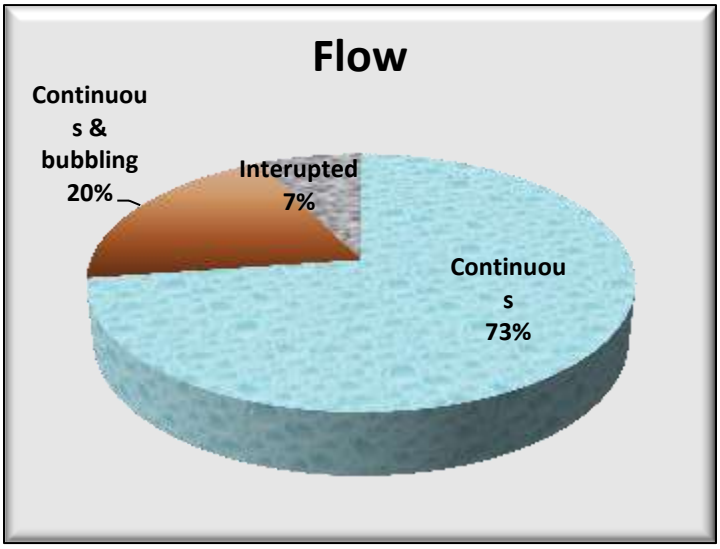


The skin condition of patients were normal (42%), dry reddish (20%)

7. Colour of removed blood



8. Flow of blood

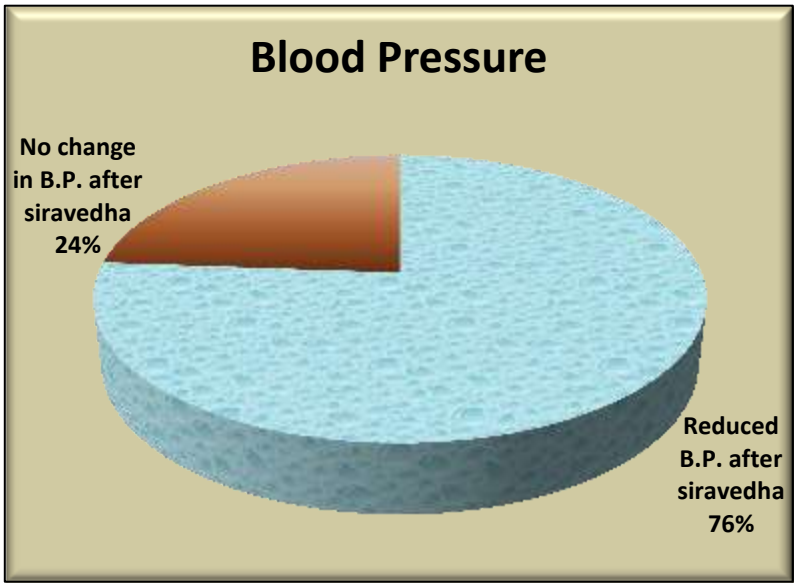


9. Viscosity of blood

Viscosity	Sticky	Thick	Thin
Frequency	1	44	120

According to colour of removed blood, maximum patients of disease Padadaha, the let out blood having colour blackish red & 72%. The flow of blood is continuous is highest (73%) & having thin consistency (viscosity is highest).

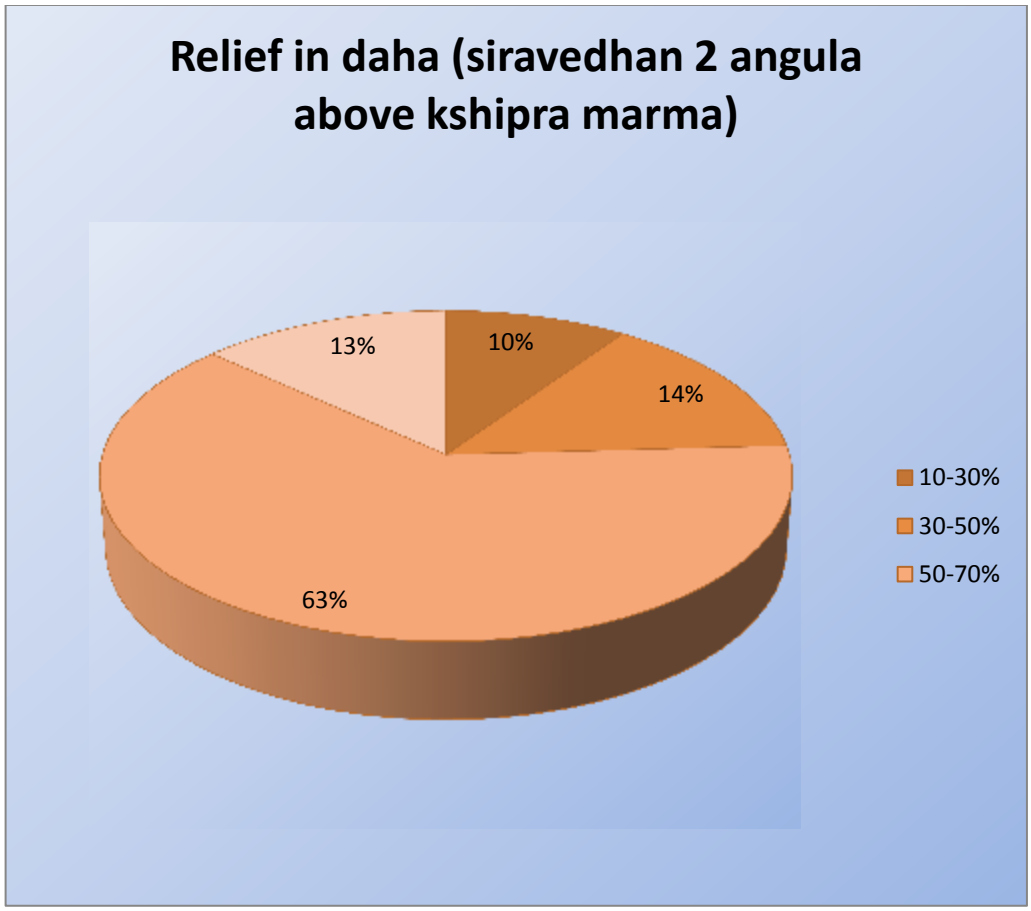
10. According to Blood Pressure



The blood pressures of patients were reduced after Siravedha in both groups is highest.

11. According to relief in daha

A. Siravedha 2angula above Kshipra marma

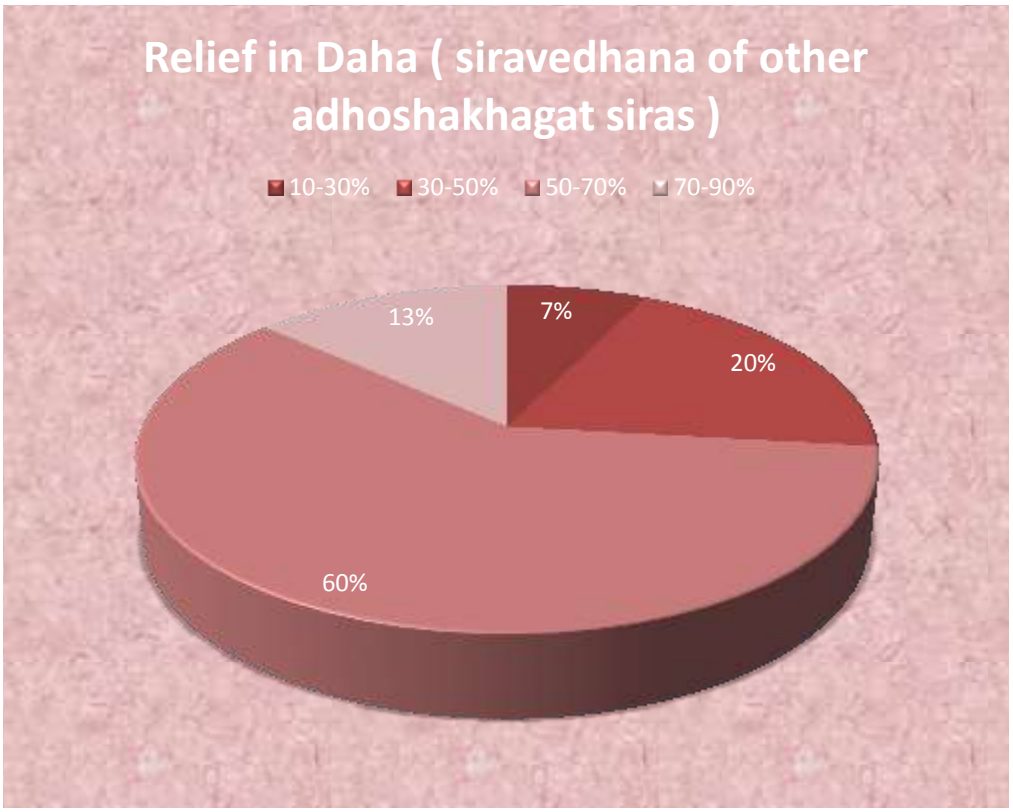


The test used is chi-square test for Goodness of fit

P value < 0.05, the level of significance.

By siravedhan of 2 angula above Kshipra marma, patients were having relief in daha was overall 76%. Relief in daha between 50-70% was of 63%.

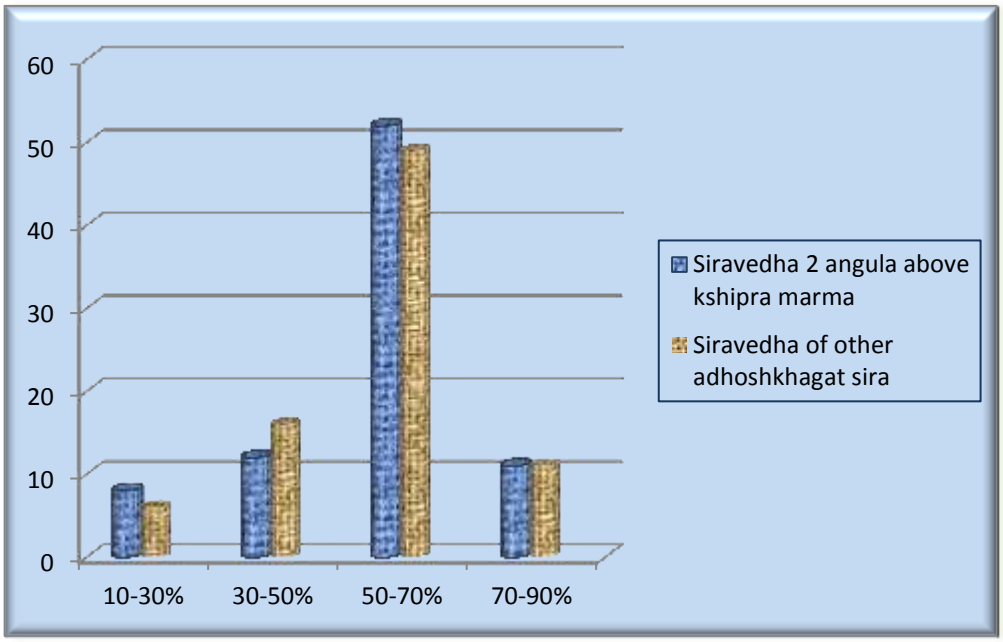
B. Siravedhan of other adhoshakhagala siras except 2 angula above Kshipra marma.



P value is < 0.05, the level of significance.

By siravedhan of other adhoshakhagat sira except 2 angula above Kshipra marma, patients were having relief in daha was overall 73%. Relief in daha between 50-70% was of 60%.

Relief in Padadaha	Siravedha 2 angula Above ksipra marma	Siravedha other Adhoshakhagala siras
10-30% (+)	08	06
30-50%(++)	12	16
50-70%(+++)	52	49
70-90% (++++)	11	11
Total	83	82



P<0.05, accept H1, Reject H0

From above statistical analysis, we can conclude that the Siravedha in Padadaha disease in both group were relieved daha. In Siravedha 2 angula Kshipra marma were 76% and in other adhoshakhagat sira relieved about 73%.

RESULTS

Medical science demands precision for its development, observation and measurement that have to be expressed in figures hence results are obtained with the help of Biostatistics.

In this study we accept the alternative hypothesis that the Siravedha of sira 2 angula above the Kshipra marma as well as other siras of adhoshakha relieve daha in patients of Padadaha.

Since the 'P' value is less than 0.01, so that we can say that, there is significant difference in the values, so the treatment of Siravyadha of particular site mentioned by Acharya Sushruta & the other sites not mentioned by Acharya seemed to be effective.

According to age group-

Maximum number of patients suffering from Padadaha were found from 41-55 years of age group and medium number of patients were found 26-40 years, 56-70 years and minimum nuber of patients were found 18-25 years.

According to Gender-

Maximum numbers of patients suffering from Padadaha were female (58%)

According to Prakruti-

Vatapradhan Prakruti seems to be more affected by Padadaha disease.
And that was 38%.

According to sharir bala-

Maximum numbers of patients were having Madhyam sharir bala i.e. 48%.

According to let out Blood-

In maximum number of patients, the impure blood which was let out was found in between 100-120 ml. In both group patients the let out blood was ceased naturally. The colour of removed (impure) blood was blackish red i.e. 72%.

According to Blood pressure-

According to Kula vrittanta, Purva vyadhi vrittanta, maximum patients of Padadaha were found to be having high blood pressure. Percentage of patients having history of increased blood pressure were seen to be more suffering from Padadaha disease & after Siravedha, it shows reduced in Blood Pressure.

Cal value=119.24 & p= 0.00

P value less than cal value, at 0.05 the level of significance.

According to flow, viscosity of blood-

Maximum numbers of patients were having continuous flow of blood. And the viscosity of blood was thin.

According to skin condition & Sira examination-

The Siras of patients having Padadaha were observed. The skin condition was normal, dry & slight reddish. The veins of adhoshakha were found prominent, thin, thready, under tension and relaxed.

The skin condition & Sira observed were seems to be Vata pradhan laxanas.

According to relief in daha

Siravedha 2angula above Kshipra marma

By siravedhan of 2 angula above Kshipra marma, patients were having relief in daha was overall 76%. Relief in daha was (between 50-70%) of 63%.

The test used is chi-square test for Goodness of fit.

Cal= 61.98 p= 0.00

P value < cal value at 0.05 the level of significance.

Siravedhan of, other adhoshakhagala siras except 2 angula above Kshipra marma.

By siravedhan of other adhoshakhagat sira except 2 angula above Kshipra marma, patients were having relief in daha was overall 73%. Relief in daha between 50-70% was of 60%.

Cal=40.15 p= 0.00

P value is < 0.05, the level of significance; there is strong evidence to reject the null hypothesis.

According to relief in Daha in both group-

The efficacy of Siravydha in 2 fingers above Kshipra Marma is more significant than the efficacy of Siravedhan in adhodhakagata other Siras. The symptoms was reduced by75- 80% in 2 finger above Kshipra Marma Siravedan in 15 days and the sysmptom was reduced 60-75% in other adhoshakhagata Sira vedhan in 15 days.

No serious conditions like fainting, collapse or excessive bleeding were seen in the patients.

The efficacy of Siravedha in both group patients showed over all 80% significant result.

The hypothesis is proved correct as the ‘P’ value for Padadaha was observed to be significant.

DISCUSSION

After the completion of Conceptual, Cadaveric and Observational studies relevant data is formed. The data is presented here for a discussion.

1. Conceptual study

The term Sira and Dhamani have been generally used in the same sense but these are not synonymous. In general, Sira mean blood vessel. According to Charaka definition of Sira, Dhamani & Srotas is said as

ध्मानात् धमन्यः स्रवणात् स्रोतांसि सरणात् सिरा |

But on the basis of interpretation of commentators 'Dhamani' is a channel connected to the heart which is thick, whereas Sira is a thin blood vessel. Dhma means pumping of rasa by heart into Dhamanis, Sru means channels where there is word'Sira' means to move slowly. So with these points view, Dhamanis are arteries. Siras are veins & Srotas are lymphatics. As per Gangadhar shastri, the classification of Sira can be understood like this.

Siras are 700 in number. Among these Siras, Acharyas clearly differentiated between the Vedhya and Avedhya Siras. Vedhya Siras those which can be interfered with surgical procedures & the Avedhya Siras are those on which injury must be avoided during surgery. Siras are classified into 4 types according to Varna.

Siraprakar	**Sirakarya**	**Tridhosh drushtya vargikaran**
Rohinyaha	Nourshing body by Upsnehana & Anugrahana	Artery - Pittavahi
Neela	Nourshing body by Upsnehanas Anugrahana	Veins- pittavahinya
Gourya	Nourshing body by Upsnehanas Anugrahana	Lymohatics- Kaphavahinya
Aruna	Akunchana Prasaranadi Karmas	Nerves- Vatavahinya

सिराव्यधश्चिकित्सार्धं शल्यतन्त्रे प्रकीर्तितः |

यथा प्रणिहितः सम्यग्वस्तिः कायचिकित्सिते ||

Siravyadha is a significant therapeutic tool, when judiciously administered. Siravyadha is accepted as half of the therapeutic measure in Salyatantra like Basti in Kayachikitsa. Half of the health hazards can be managed by Siravyadha as Rakta is being chief causative factor in the manifestation of diseases. The concept of Shodhana therapy in Ayurveda in concerned, always Doshas should be removed from nearest routes. Raktamokshana is also one of the Shodhan therapies, so it is recommended to remove the viated blood from nearest route of roga adhisthana. So that, sites of Siravyadha dealt by Acharya Sushruta is only with the aim of that dushita Rakta should be expelled out from sameepastha marga. With this motive, he might have been told particular sites for Siravyadha in particular diseased conditions. He has recommended only Siras which are superficially situated on the contrary contraindicated by vyadhana of Siras deeply situated on the basis of said principles. Acharya Sushruta might have been told particular vyadhana Sthana in different disease conditions.

When we have reviewed Anatomy, Physiology, Circulation, Venous System on the grounds of literary principles, the sites of Siravyadha dealt by Acharya Sushruta are found to be correct as blood letting from particular site is effective in resolving the pathology of diseased conditions & beneficial in neutralizing physiological mechanisms by various changes in the body. As the body has got its own capacity to compensate during blood loss, performing many defense actions to resolve pathology & to maintain homeostasis, cellular level changes have been brought by various metabolic changes. As the blood is circulating in the closed circuit, providing oxygen nutrients etc. and carry waste metabolic products. Every cell has got its own control to fulfill the needs itself.

From Ayurvedic literature Siras are correlated with vein in modern anatomy. Veins are playing very important role in pulmonary & systematic circulation. The veins are considered as reservoirs of blood & also they are very essential to maintain proper circulation, cardiac output drainage & venous return in the mechanism of homeostasis. The arteries, veins & capillaries have similar

structural component with little difference. The veins are thin walled and less elastic tissue present. It has three layers namely 1. Tunica intima- made up of endothelium performing diffusion growth of new cells 2. Tunica media- thin layer of smooth muscle –in veins with properties like distensibility, elasticity, rigidity 3. Tunica adventitia- formed by general connective tissue with varying thickness.

2. Cadaveric Study

During dissection of 8 cadavers, following points were observed & noted.

Veins were more superficial & more in number than arteries. They were blue coloured with clotted blood. They have valves directed towards direction of blood flow. In lower extremity blood flows against gravity, hence they have valves to prevent back flow of blood. Arterioles, capillaries & venules were very thin. The dorsal venous arch formation was found. No variation in dorsal venous arch was found.

Out of hundred Siras four Avedhya siras mentioned by Acharya Sushrut, in one Sakti, among these one Sira is Jaladhara and internal Siras known as Urvis-two and one Lohitaksha. They are not fit for venesections. Dr Bhaskar Govind Ghanekar has accepted great saphenous vein in lower extremities as Jaladhar. Femoral vein in lower extremity have been considered as Urvi and Lohitaksha Sira. The great saphenous vein is superficial structure; therefore, it should be protected. Femoral vein is deep seated structure and should not be taken for venesection.

Superficial Veins the great and small saphenous veins and their tributaries. They lie in the superficial fascia, on the surface of the deep surface. Deep Veins are the anterior and posterior tibial, peroneal, popliteal, & femoral veins and their tributaries. Perforating Veins connect the superficial with the deep veins. There are about five perforators along the great saphenous vein, and one perforator along the small saphenous vein. All the veins of lower extremity were observed.

According to Ayurveda literature, the vein two angula above Kshipra Marma was seen in the cadaver as dorsal venous arch which is formed by four dorsal meta-tarsal veins each of which is receives the union of two dorsal digital veins. The other Siras which are not mentioned by Acharya Sushruta were observed. The short Saphenous vein, lateral & medial marginal veins were observed & no variations were found.

3. Observational Study

Total number of 200 patients, 165 patients are examined & selected for Siravyadha. 35 patients are dropped out of the observational study.

In Padadaha disease, excess walking causes Vata prakopa in the body. This prakupita Vata associated with Pitta & Rakta dosha localized in the pada later, manifesting the burning sensation in foot. Nidan parivarjana plays the major part for further preventing the Padadaha disease.

Kshipra marma is a snayu type of marma. It measures Ardhangula in Anguli pramana. It is also a Kalantara pranahara marma. According to the location it can be located in first Intermetatarsal space. Anatomical structures involved are Adductor hallicis bravis, lumbricalis muscles, deep peroneal nerve, dorsal metatarsal artery plantar arch and medial planter artery.

According to Acharya Sushrut, in diseases Padadaha, the vein situated two Angula (4 cm) above the Kshipra Marma should be punctured using Vrihimukha Shastra. Anatomically the dorsal venous arch is located 2 angula above Kshipra marma. 83 patients suffering from Padadaha were treated with Siravedha to fingers above the Kshipra Marma & which is mentioned by Acharya Sushruta in particular disease. The dorsal venous arch which is superficial lies above Kshipra marma, punctured to see the efficacy in Padadaha disease. The efficacy of Siravedha 2 angula above Kshipra marma showed overall 75% significant result. 82 patients who were suffering from Padadaha treated by Siravedha other

adhoshakhagata Sira which are not mentioned by Acharya Sushruta in particular disease. The short saphenous vein, right marginal vein & left marginal veins which are superficial & can be easily assessable were punctured to see the efficacy in Padadaha disease. The efficacy of Siravedha of other adhoshakhagata sira which are not mentioned by Acharya Sushruta in adhoshakha showed over all 73% significant result.

The internal medicine given by physician were Arogyavardhini 1gm twice a day with warm water and Gandarva haritaki 2gm at night with warm water. The drug arogyavardhini is useful in all diseases. It improves overall good health by balancing all the three dosha. It possess the pharmacological action like kushtanashaka,can alleviate all types of skin disorder. Gandarva haritaki churana has mridu virechaka action. It removes impurities from body. It is effective in diseases caused by vata dosha. These drugs seemed effective in patients of Padadaha who had vaivarnya, dry, black skin. The skin condition of patients were found normal is of 42%.

CONCLUSION

1. Adhoshakhagata Sira Vedha two fingers above KshipraMarma in Paddaha shows significant result. As per statistical analysis 80% patients were totally cured from above particular site Siravedhan.

2. Hence the site of Siravyadha i.e. the sira present two fingers above Kshipra Marma, mentioned by Acharya Sushrut in Padadaha disease is scientific.

3. The statistical analysis also shows 75% were cured by other Adhoshakhagata Sira vedhan so other Adhoshakhagata Siras which are not mentioned by Acharya Sushruta in Padadaha disease can be adopted when particular said site for vedhan is not available.

4. Siravyadha is effective therapeutic tool in many health problems if judiciously administered and it is beneficial in physiological maintenance of well-being.

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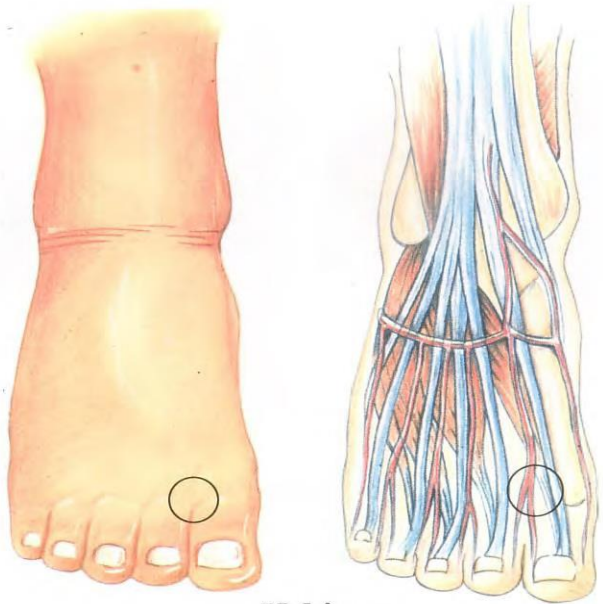
Hypothesis

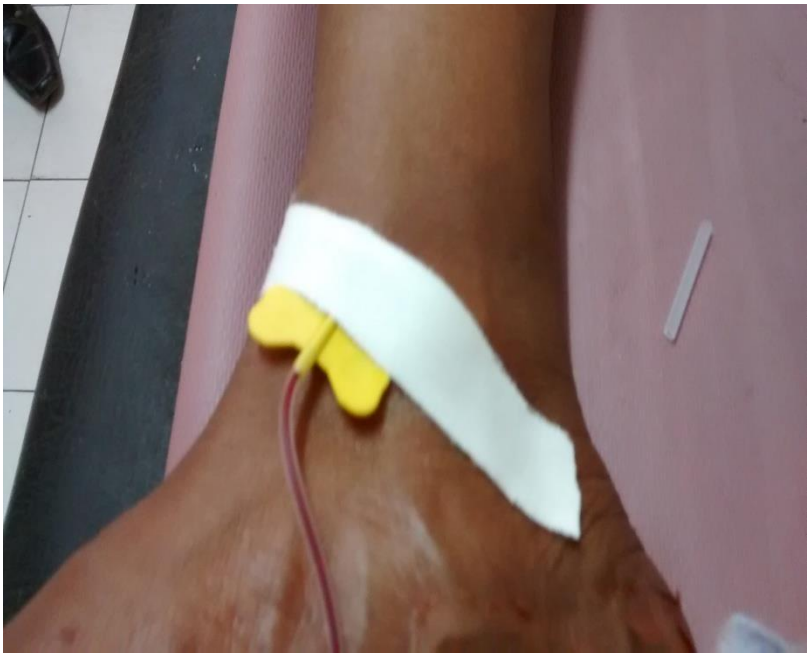
H0= The sira vedhan of sira which lies 2 angula above Kshipra marma and the sira vedhan of other adhoshakhagat siras not relieve daha in patients of Padadaha.

H1= The sira vedhan of sira which lies 2 angula above Kshipra marma and the sira vedhan of other adhoshakhagat sira relieve daha in patients of Padadaha.



Kshipra

Siravedha at 2 angula above kshipra marma



Siravedha of other Adhoshakhagata sira

Veins of lower limb