"COMPARATIVE STUDY OF VEDHYA AND AVEDHYA SIRA DESCRIBED BY SUSHRUTA VERSUS SIRAVEDHA METHODS OF DIFFERENT SCHOOLS IN VOGUE"

A THESIS SUBMITTED TO
BHARATI VIDYAPEETH UNIVERSITY, PUNE
FOR AWARD OF DEGREE OF
DOCTOR OF PHILOSOPHY IN RACHANA SHARIR
UNDER THE FACULTY OF AYURVED

SUBMITTED BY
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UNDER THE GUIDANCE OF
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“ नमामिधन्वन्तरिम् आदिदेवम् सुरासुरैः वन्दितपादपद्मम् |

लोकेजरारूक्भयमृत्युनाशनम् धातारमीशंविविधौषधीनाम् ||”

DECLARATION BY THE CANDIDATE

I, hereby, declare that the thesis entitled **"Comparative Study Of Vedhya And Avedhya Sira Described By Sushruta Versus Siravedha Methods Of Different Schools In Vogue"** submitted by me to the **Bharati Vidyapeeth University, Pune** for the degree of **Doctor of Philosophy (Ph.D.)** in **Rachana Sharir** under the faculty of **Ayurved** is original piece of work carried out by me under the supervision of **Dr. Sanjay V. Pandit.**

I further declare that it has not been submitted to this or any other university or Institution for the award of any degree or Diploma. I also confirm that all the material which I have borrowed from other sources and incorporated in this thesis is duly acknowledged. If any material is not duly acknowledged and found incorporated in this thesis, it is entirely my responsibility. I am fully aware of the implications of any such act which might have been committed by me advertently or inadvertently.

Place : Pune

Dr. Rupaji Jagannath Kadam

Date : / /

CERTIFICATION OF GUIDE

This is to certify that the work incorporated in the thesis entitled **"Comparative Study Of Vedhya And Avedhya Sira Described By Sushruta Versus Siravedha Methods Of Different Schools In Vogue"** Submitted by **Dr. Rupaji Jagannath Kadam** for the degree of **'Doctor of Philosophy' (Ph.D.)** in the subject of **Rachana Sharir** under the faculty of **Ayurved** has been carried out in the Department of **Rachana Sharir**, Bharati Vidyapeeth's college of **Ayurved**, Pune during the period from 2011 to 2016 under my guidance.

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INDEX

INTRODUCTION

Ayurveda- The ancient Indian health science having main eight branches of practice. *Kayachikitsa* and *Shalyachikitsa* are two principle areas having their own clinical requirements, likewise Kayachikitsa is medicine oriented branch and Shalyatantra surgery oriented. But for their understanding for practioner / students the knowledge of anatomy is essential.

While learning anatomy with *Ayurvedic* perspective, students encounter number of controversial concepts which have to be clarified e.g. *Srotas, Snayu, Sira, Kala* etc.

Sira is one of the intricate, controversial but essential concepts that is to be understood. *Sushruta* has stated *Siravedha* as a half (prime) the *Chikitsa* in *Shalyatantra* like *Basti* in *Kayachikitsa*[1,] which is one of the important modalities in practice in the management of various diseases.

सिराव्यधश्चिकित्सार्धं शल्यतन्त्रे प्रकीर्तितः ।।
यथा प्रणिहितः सम्यग्बस्तिः कायचिकित्सिते ।।

सु.शा.८/२३

Sushruta has mentioned specific sites for *Siravedha*[2] and sites for *Avedhya Sira*[3]. *Vedhan* of *Avedhya Sira* leads to either grievous deformity or death[4].

अत ऊर्ध्वं प्रवक्ष्यामि न विध्येद्याः सिरा भिषक् ।।
वैकल्यं मरणं चापि व्यधात्तासां ध्रुवं भवेत् ।।

सु.शा.७/१९

For the desired outcome in treatment and to avoid complications due to puncture of *Avedhya Sira*, complete knowledge of *Siravedha vidhi* is essential. So it becomes invariably essential to find out the anatomical structures to which one can label as *Vedhya* and *Avedhya Sira.* And it is inevitable to explore whether the *Siravedha* method described by *Sushruta* and in practice are same or not.

Hence, the study work designed is entitled as "Comparative study of *Vedhya* and *Avedhya Sira* described by Sushruta versus *Siravedha* methods of different schools of thoughts in vogue."

REFERENCES:

1. Yadavaji Trikamji Acharya, (Reprint, 2013) Sushruta Samhita 'Commentary of Shri Dalhanacharya, Chowkhamba Sanskrit Sansthan, Varanasi, Sharirsthan Chapter- 8, verse-23.Pg.383.

2. Yadavaji Trikamji Acharya, (Reprint, 2013) Sushruta Samhita 'Commentary of Shri Dalhanacharya, Chowkhamba Sanskrit Sansthan, Varanasi, Sharirsthan Chapter- 8, verse-17. Pg.381.

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PREVIOUS WORK DONE

From previous work regarding *Sira,* study of thesis of Dr. Mrs. M. S. Dhotre and Dr. Shelake D. S. was carried out in detail. These two studies were relevant with our topic.

1) Title- Conclusive differentiation of *Shushrutokta Sira*[1].

Conclusion- Types of *Sira* i.e. *Aruna, Neela, Gauri* and *Rohini* are to be considered as Capillaries, Veins, Lymph vessels and Arteries respectively.

2) Title- Anatomical location of *Shakhasthita Avedhya Sira* with special reference to *Lohitaksha and Aurvi Sira*[2].

Conclusion:-1)The great sephanous vein in the lower limb and the cephalic vein in upper limb can be termed as *Jaladhara Sira* of respective limb.
2) The femoral artery and femoral vein enveloped in the femoral sheath disguising as one vessel in lower limb and the axillary artery and vein enveloped in a sheath also disguising as one vessel in the upper limb can be termed as *Lohitaksha Sira* of respective limb.
3) The femoral artery and femoral vein inside the adductor canal in the lower limb can be Called *Aurvi Sira,* where as the Brachial artery and vein in the upper arm can be called *Bahavi Sira.*

The previous studies were based upon only literature study and limited to study of Shakhagat *Vedhya* and *Avedhya Sira.* To extend the boundaries of existing work by studying entire *Vedhya* and *Avedhya Sira* and to make it more comprehensive by including survey and retrospective documented post-mortem case study, the above study has been designed.

References:

1. Dhotre M.S., (1996-2001),"Conclusive differentiation of Shushrutokta Sira", Ph.D. Thesis, University of Pune. Pg.98
2. Shelake D.S., (1994), "Anatomical location of Shakhasthita Avedhya Siras with special reference to Lohitaksha & Aurvi Sira", M.D Dissertation, Marathwada University, Pg.45

AIM AND OBJECTIVES

AIM:

To confirm anatomical structure of *Vedhya* and *Avedhya Sira* and to understand their concept in present era

OBJECTIVES:

1. To correlate *Sira* with modern anatomical structure
2. To differentiate the *Vedhya* and *Avedhya Sira*
3. To explore whether, the *Siravedha* method described by *Sushruta* and *Siravedha* methods of different schools in vogue are same or not.

REVIEW OF LITERATURE

A) AYURVED LITERATURE REVIEW:-

Utpatti* of *Sira:

मेदसः स्नेहमादाय सिरास्नायुत्वमाप्नुयात् ।।
सिराणां तु मृदुः पाकः स्नायूनां च ततः खरः ।।

सु.शा.४/२९.३0

In *Garbhavastha Vata takes sneha* from *Meddhatu* and form the *Sira* and *Snayu*[1].

गर्भस्यकशश्मश्रुलामास्थिनखदन्तसिरास्नायुधमनीरतःप्रभतीनि स्थिराणि
पितजानि,मांसशाणितमदामज्जहृन्नाभियकत्प्लोहान्त्रगुदप्रभतीनि मदूनि मातजानि,

सु.शा.३/३३

Sira are the *Pitruj bhava* and *upadhatu* of *Rakta*.[2]

***Nirukti*:**

सरणात्सिराः|

च.सू.३0|१२

Because of the action of carrying a substance from one place to another are called *Sira.*[3]

***Moola sthan* of *Sira*:**

सप्त सिराशतानि भवन्ति, याभिरिदं शरीरमाराम इव जलहारिणीभिः केदार इव च कुल्याभिरुपस्निह्यतेऽनुगृह्यते चाकुञ्चनप्रसारणादिभिर्विशेषैः, द्रुमपत्रसेवनीनामिव तासां प्रतानाः, तासां नाभिर्मूलं, ततश्च प्रसरन्त्यूर्ध्वमधस्तिर्यक् च ।।

सु.शा.७/३

There are seven hundred *Sira* by which the body is nourished like garden by water-carriers and like field by irrigating channels and also benefitted with activities such as contraction, extension etc. Their ramifications are as venation in a leaf, their root is umbilicus wherefrom they spread upwards, downwards and obliquely[4].

व्याप्नुवन्त्यभितो देहं नाभितः प्रसृताः सिराः ।।
प्रताना: पद्मिनीकन्दाद्विसादीनां यथा जलम् ।।

सु.शा.७/२३

Sira originating from umbilicus spread and pervade all around in the body as branches of stem etc. from the lotus stock spread in water[5].

Number and distribution of *Sira*:

तासां मूलसिराश्चत्वारिंशत्, तासां वातवाहिन्यो दश, पित्तवाहिन्यो दश, कफवाहिन्यो दश, दश रक्तवाहिन्यः । तासां तु वातवाहिनीनां वातस्थानगतानां पञ्चसप्ततिशतं भवति, तावत्य एव पित्तवाहिन्यः पित्तस्थाने, कफवाहिन्यश्च कफस्थाने, रक्तवाहिन्यश्च यकृत्प्लोह्नोः, कफवाहिन्यश्च कफस्थाने, रक्तवाहिन्यश्च यकृत्प्लोह्नोः, एवमेतानि सप्त सिराशतानि ।।

सु.शा.७/६

Mool Sira carring *dosha* are 40i.e. *Vatavahi, Pittavahi, Kaphavahi, Raktavahi* –each 10 in number. These *Sira* run in their particular *sthana* and each divided and redivided into 175 branches. Therefore total *Sira* are 700.[6]

Clasification of *Sira:*-

तत्र वातवाहिन्यः सिरा एकस्मिन् सक्थ्नि पञ्चविंशतिः; एतेनेतरसक्थि बाहू च व्याख्यातौ । विशेषतस्तु कोष्ठे चतुस्त्रिंशत्; तासां गुदमेढ्राश्रिताः श्रोण्यामष्टौ, द्वे द्वे पार्श्वयोः, षट् पृष्ठे, तावत्य एवोदरे, दश वक्षसि । एकचत्त्वारिंशज्ञत्रुण ऊर्ध्वं; तासां चतुर्दश ग्रीवायां, कर्णयोश्चतस्रः, नवजिह्वायां, षण् नासिकायां, अष्टौ नेत्रयोः, एवमेतत् पञ्चसप्ततिशतं वातवाहिनीनां सिराणां व्याख्यातं भवति । एष एव विभागः शेषाणामपि । विशेषतस्तु पित्तवाहिन्यो नेत्रयोर्दश, कर्णयोर्द्वे; एवं रक्तवहाः कफवहाश्च । एवमेतानि सप्त सिराशतानि सविभागानि व्याख्यातानि।।

सु.शा.७/७

Vata carring *Sira* are twentyfive in one leg, same number in the other leg and also in two arms.

In the *Koshta* (trunk) specially there are thirtyfour, out of these eigth are in the pelvis regions attached with the anus and the penis, two in each flank, six in back, the same number in the udar (abdomen) and ten in the chest.

There are fourtyone in parts above the shoulders, out of these, fourteen are in the neck, four in the ears (two each), nine in the tongue, six in the nose, and eight in the eyes (four each)

In this way, one hundred seventy five *Vata* carring *Sira are* described. Similar is the manner of classification (counting) of the remaining *Sira*, in case of *Pittavahi Sira* especially, ten are in the eyes (five each), two in the ears (one each), similarly also *Raktavaha* and *Kaphavaha.*[7]

***Sira* are classified into 4 types according to *Dosha*.**

तत्रारुणा वातवहाः पूर्यन्ते वायुना सिराः ।।
पित्तादुष्णाश्च नीलाश्च, शीता गौर्यः स्थिराः कफात्
असृग्वहास्तु रोहिण्यः सिरा नात्युष्णशीतलाः ।।

सु.शा.७/१८

1. *Vatavahi*
2. *Pittavahi*
3. *Kaphavahi*
4. *Raktavahi*

Vatavahi Sira are blackish red in colour and filled with *Vata*, *Pittavaha Sira* are warm and blue in colour, *Kaphavaha Sira* are cold, white and stable and *Raktavaha Sira* are red in colour and neither very hot nor very cold.[8]

***Sira* as *Doshvaha* and *Sarvavaha*:**

न हि वातं सिराः काश्चिन्न पित्तं केवलं तथा ।।
श्लेष्माणं वा वहन्त्येता अतः सर्ववहाः स्मृताः ।।१६।।
प्रदुष्टानां हि दोषाणां मूर्च्छितानां प्रधावताम् ।।
ध्रुवमुन्मार्गगमनमतः सर्ववहाः स्मृताः ।।१७।।

सु.शा.७/१६, १७

Sira conveys *Rasarakta* and *Dosha* also. From above description it is clear that each *Sira* convey a particular *Dosha*. But *Sushrutacharya* stated that these *Sira* are *Sarvavaha*. i.e. each *Sira* convey all dosha with them in more or less quantity and termed according to dominance of dosha. Hence they termed as "*Doshvaha* and *Sarvavaha Sira*".[9]

Specific functions of *Sira* according to *Dosha*: [10]

1. *Vatavahi Sira*:

क्रियाणामप्रतीघातममोहं बुद्धिकर्मणाम् ।।
करोत्यन्यान् गुणांश्चापि स्वाः सिराः पवनश्चरन् ।। सु.शा.७/८

1. They allow free and good activities of the body.
2. Give the precise perception.
3. Extinguish the confusion in perception of sense organs and mind.

2. *Pittavahi Sira:*

भ्राजिष्णुतामन्नरुचिमग्निदीप्तिमरोगताम् ।।
संसर्पत् स्वाः सिराः पित्तं कुर्याच्चान्यान् गुणानपि ।। सु.शा.७/१०

1. They maintain the health.
2. Give lustre to skin.
3. Increase appetite.

3. *Kaphavahi Sira*:

स्नेहमङ्गेषु सन्धीनां स्थैर्यं बलमुदीर्णताम् ।।
करोत्यन्यान् गुणांश्चापि बलासः स्वाः सिराश्चरन् ।। सु.शा.७/१२

1. They keep the body *sneegdha*.
2. Well lubricate the joints.
3. Make the limbs firm, strong and well developed.

4. *Raktavahi Sira*:

धातूनां पूरणं वर्णं स्पर्शज्ञानमसंशयम् ।।स्वाः सिराः संचरद्रक्तं कुर्याच्चान्यान् गुणानपि।।

सु.शा.७/१४

1. They nourish the *saptadhatu* of body.
2. Give lustre to skin.
3. Touch became very keen and perception acute.

Functions of *Vikrutavasta* of *Dosha*: [11]

1. *Vatavahi Sira*:

यदा तु कुपितो वायुः स्वाः सिराः प्रतिपद्यते ।।
तदाऽस्य विविधा रोगा जायन्ते वातसंभवाः ।। सु.शा.७/९

They create symptoms of *Vatadushti*.

2. *Pitavahi Sira*:

यदा प्रकुपितं पित्तं सेवते स्ववहाः सिराः ।
तदाऽस्य विविधा रोगा जायन्ते पित्तसंभवाः ।। सु.शा.७/११

They create symptoms of *Raktadushti*.

3. *Kaphavahi Sira*:

यदा तु कुपितः श्लेष्मा स्वाः सिराः प्रतिपद्यते ।।
तदाऽस्य विविधा रोगा जायन्ते श्लेष्मसंभवाः ।। सु.शा.७/१३

They create symptoms of *Kaphadushti*.

4. *Raktavahi Sira*:

यदा तु कुपितं रक्तं सेवते स्ववहाः सिराः ।।
तदाऽस्य विविधा रोगा जायन्ते रक्तसंभवः।।
सु.शा.७/१५

Vitiated Rakta circulating through *Raktavahi Sira* and create different diseases of *Raktadushti*.

Disribution of *Sira* in the Body: [12]

सिराशतानि चत्वारि विद्याच्छाखासु बुद्धिमान् ।।
षट्त्रिंशच्च शतं कोष्ठे चतुःषष्टं च मूर्धनि ।। सु.शा.७/२०

	Anga	**No. of *Sira***
1	*In shakha*	400
2	*In koshta*	136
3	*In shirogriva*	164
	Total =	**700**

तत्र वातवाहिन्यः सिरा एकस्मिन् सक्थ्नि पञ्चविंशतिः; एतेनेतरसक्थि बाहू च व्याख्यातौ । विशेषतस्तु कोष्ठे चतुस्त्रिंशत्; तासां गुदमेढ्राश्रिताः श्रोण्यामष्टौ, द्वे द्वे पार्श्वयोः, षट् पृष्ठे, तावत्य एवोदरे, दश वक्षसि । एकचत्त्वारिंशज्जत्रुण ऊर्ध्वं; तासां चतुर्दश ग्रीवायां, कर्णयोश्चतस्रः, नवजिह्वायां, षण् नासिकायां, अष्टौ नेत्रयोः, एवमेतत् पञ्चसप्ततिशतं वातवाहिनीनां सिराणां व्याख्यातं भवति । एष एव विभागः शेषाणामपि । विशेषतस्तु पित्तवाहिन्यो नेत्रयोर्दश, कर्णयोर्द्वे; एवं रक्तवहाः कफवहाश्च । एवमेतानि सप्त सिराशतानि सविभागानि व्याख्यातानि।।

सु.शा.७/७

***Shakhagat Sira*: 400[13]**

VatavahiSira	-	25 x 4	=	100
PittavahiSira	-	25 x 4	=	100
KaphavahiSira	-	25 x 4	=	100
RaktavahiSira	-	25 x 4	=	100
		Total	**=**	**400**

***Koshtagata Sira*: 136[13]**

In *Guda*, *Medhra* and *Shroni*	8x4	32
In *Parshwa*	4x4	16
In *Prushta*	6x4	24
In *Udara*	6x4	24
In Ura	10x4	40
	Total =	**132**

***Urdhwajatrugat Sira*: 164[13]**

Griva	14 x 4	56
Karna	4 x4	16
Jivha	9 x4	36
Nasa	6 x 4	64
Netra	8 x 4	32
	Total =	**164**

Importance of *Raktamokshana:*

Raktamokshan is one of the important modalities in the treatment of *shonitdustjanya* diseases[14].

***Raktamokshana* can be done by following methods according to the amount of *Dushti*.**

सिराविषाणतुम्बैस्तु जलौकाभिः पदैस्तथा ।।
अवगाढं यथापूर्वं निर्हरेद्दुष्टशोणितम् ।। सु.शा.८/२५

1. ***Siravedha***
2. ***Tumbi***
3. ***Srunga***
4. ***Jalaukavacharana***
5. ***Prachhankarma***

The Vitiated blood should be eliminated by *Siravedha* (puncturing the vein), *Srunga* (horn), *Tumbi* (groud), *Jalauka* (leech) and *Prachhankarma* (scarification) in regressive order according to depth of the morbidity[15].

अवगाढे जलौका स्यात् प्रच्छन्नं पिण्डिते हितम् ।।
सिराऽङ्गव्यापके रक्ते शृङ्गालाबू त्वचि स्थिते ।। सु.शा.८/२६

In Deep seated malady (complicated sthan) *Jalauka* (leech) is preferable for *Siravedha*.
In localised lump (For aggregated blood or for collected vitiated rakta dosha) *Prachhankarma* (scarification) is useful.
In case of generalised vitiation of blood (*Rakta Dushti* is allover body), then *Siravedha* procedure is used for *Raktmokshan*.
While *Raktdushti* is in skin only (in the disorder situated in skin), then *Tumbi* (gourd) or *Srunga* (horn) are applied[16].

Out of these, *Siravedha* is the most important and effective treatment.

Imporatance of *Siravedha* in *Raktamokshan*:

स्नेहादिभिः क्रियायोगैर्न तथा लेपनैरपि ।।
यान्त्याशु व्याधयः शान्तिं यथा सम्यक् सिराव्यधात् ।। सु.शा.८/२२

Diseases do not get pacified so quickly by therapeutic measures like *Snehan, Swedan* etc. and pacified as by *Siravedha*.[17]

सिराव्यधश्चिकित्सार्धं शल्यतन्त्रे प्रकीर्तितः ।।
यथा प्रणिहितः सम्यग्बस्तिः कायचिकित्सिते ।। सु.शा.८/२३

Sushruta has stated *Siravedha* as half (prime) the *chikitsa* in *Shalyatantra* like *basti* in *Kayachikitsa*[18].

सिराव्यधश्चिकित्सार्धंसंपूर्णं वा चिकित्सितम् शल्यतन्त्रे स्मृतो
यद्वद्बस्तिःकायचिकित्सिते ।। अ.सं.सू.३६/४

यथारक्तमधिष्ठानं विकाराणां विकारिणाम् अन्यज हि तथा दूष्यं कर्मेदं
प्रथमं ततः।। अ.सं.सू. ३६/ ५

Venesection is half the treatment or even full treatment in *Shalyatantra* (Surgery), just as the enema therapy is describes (as half the treatment or even full treatment) for all the diseases of *Kayachikitsa* (internal medicine) [19].

Because blood is the seat for all diseases and there is no other *Dusya* (tissue that gets vitiated) than blood in patients of such diseases; so this therapy (*Siravedha)* is the first (important) [20].

As there are some important *Sira* which shouldbe avoided from puncturing while doing *Siravedha.* The knowledge of *Sira Sharir* is important in this procedure.

वैद्यो मर्मसिरास्नायुसन्ध्यस्थिधमनीष्वदुष्ट परिहरन्, अनुलोमं शस्त्रं निदध्यादापूयदर्शनात्,
सु.सु.५/७

Vaidya should avoid *Marma, Sira, Snayu, Sandhi, Asthi* and *Dhamani* while performing any operation[21].

Avedhya Sira:

अत ऊर्ध्वं प्रवक्ष्यामि न विध्येद्याः सिरा भिषक् ।।
वैकल्यं मरणं चापि व्यधात्तासां ध्रुवं भवेत् ।। सु.शा.७/१९

Physician should insure that *Avedhya Sira* are avoided from puncturing. Their puncturing might cause either disability or death[22].

As these *Avedhya Sira* are mostly situated in the *Marmasthanas*, knowledge of *Marma Sharir* is also very essential for *Siravedha*.

Out of 700 *Sira*, 98 are stated as *Avedhya Sira.*

<u>Area wise distribution of 98 *Avedhya Sira*:</u>

शाखासु षोडशः सिराः कोष्ठे द्वात्रिंशदेव तु ।।
पञ्चाशज्जत्रुणश्चोर्ध्वमव्यध्याः परिकीर्तिताः ।।
सु.शा.७/२१

	Anga	**No. of *Sira***
1	In *Shakha*	16
2	In *Koshta*	32
3	In *Shirogriva*	50
	Total =	**98**

Sushruta has mentioned 16 *Avedhya Sira* in *Shakha*, 32 in *Madhya Sharir* and 50 in *Urdhwajatru* with their name and site[23].

Area wise distribution of 98 *Avedhya Sira*[24]*:*

Sr. No.	Sthan	Name of Sira	Sankhya
1.Shakha	***Adhoshakha (8)***	*Jaldhara*	1 (in each *Shakha*) x 2 = 2
		Urvi	2 (in each *Shakha*) x 2 = 4
		Lohitaksha	1 (in each *Shakha*) x 2 = 2
	Urdhwashakha(8)	*Jaldhara*	1 (in each *Shakha*) x 2 = 2
		Urvi	2 (in each *Shakha*) x 2 = 4
		Lohitaksha	1 (in each *Shakha*) x 2 = 2
2.Madhya Sharir	***Shroni (8)***	*Vitapgat*	2+2 = 4
		Katiktarun	2+2 = 4
	Parshva(4)	*Urdhvaga*	2
		Parshva-Sandhigat	2
	Prushtha(2)	*Bhruhati*	2
	Udara (4)	*Medhropari Ubhayata*	2+2 = 4
	Vaksha (14)	*Hridaya*	2
		Stanamool	2+2 = 4
		Stanarohit *Apalap* *Apastmbha*	0n each side of these there are 8 Sira
3.Urdhwajatru	***Griva (16)***	*Nila* *Manya* *Matruka*	2 2 8 Total=12
		Krikatika	2
		Vidhura	2
	Hanu (4)	*Sandhi dhamanis*	2+2 = 4
	Jivha (4)	*Rasvahe 2 + Vagvahe2*	2+2=4
	Nasa (5)	*Aupannasikya 4+* *Talugat 1*	4 +1 = 5
	Netra (2)	*Apanga*	1+1=2
	Karna (2)	*Shabdavahi*	2
	Lalat (7)	*Keshantgata*	4
		Avarta	2
		Sthapani	1
	Shankha (2)	*ShankhaSandhigata*	2
	Shir	*Utkshepa* *Simant* *Adhipati*	2 5 1

Relations of *Sira* and *Dhamani*:

चतुर्विंशतिर्धमन्यो नाभिप्रभवा अभिहिताः । तत्र केचिदाहुः - सिराधमनीस्रोतसामविभागः, सिराविकारा एव हि धमन्यः स्रोतांसि चेति । तत्तु न सम्यक्, अन्या एव हि धमन्यः स्रोतांसि च सिराभ्यः; कस्मात्? व्यञ्जनान्यत्वान्, मूलसन्नियमात्, कर्मवैशेष्यात्, आगमाच्च; केवलं तु परस्परसन्निकर्षात् सदृशागमकर्मत्वात् सौक्ष्म्याच्च विभक्तकर्मणामप्यविभाग इव कर्मसु भवति ।। सु.शा.९/३

There are 24 *Dhamani* in the body which are originated from the umbilicus. Some says that there is no difference among *Sira, Dhamani* and *Srotas* as *Dhamani* and *Srotas* are only transformation of *Sira*. This is not correct; (in fact) *Dhamani* and *Srotas* are the entities other than *Sira* because of

1) ***Vyanjananyatvata***
2) ***Mulasanniyamata***
3) ***Karmavisheshyata***
4) ***Agamata***

1. ***Vyanjananyatvata:*** *Dalhanacharya* stated that as *Sira* convey *Vatadi Dosha,* they termed as per their *Dosha* and they also termed as per their appearance i.e. *Aruna, Neela, Gauri* and *Rohini*. But the colour of *Dhamani* was not stated anywhere.

2. ***Mulasanniyamata*:** Initially *Sira* are 40 in numbers, *Srotas* are 22 and *Dhamani* are 24. There is difference in their number.

3. ***Karmavisheshyata***: Functions of *Sira* and *Dhamani* are different. *Sira* convey *Rasarakta* as well as ojas and nourish the body. *Dhamani* help to carry the five senses of perception, viz, sound, touch, vision, taste and smell sensations.

4. ***Agamata***: There are many references about the differentiation of *Sira* from *Dhamani* in *Ayurvedic* classics[25].

Number and Distribution of *Dhamani*:

तासां तु खलु नाभिप्रभवाणां धमनीनामूर्ध्वगा दश, दश चाधोगामिन्यः, चतस्रस्तिर्यग्गाः।।

सु.शा.९/४

Of them *Dhamani* originating from umbilicus ten go upwards, ten downwards and four obliquely[26].

स हृदयाच्चतुर्विंशतिधमनीरनुप्रविश्योर्ध्वगा दश दशाधोगामिन्यश्चतस्रश्च तिर्यग्गाः कृत्स्नं शरीरमहरहस्तर्पयति वर्धयति धारयति यापयति चादृष्टहेतुकेन कर्मणा ।।

सु.सु.१४/३

24 *Dhamani* reach to *Hrudya* and from their 10 run upward, 10 downward and 4 run oblique and nourish the body day and night[27].

Commentry of *Acharya Indu*:

धमन्यो विशिष्टे सिरा एव ।
ताश्च संख्या चतुर्विंशति ।। अ. सं.शा. ६ (इन्दुटीका)

It is stated that *Dhamani* are typical type of *Sira*. They are 24 in number[28].

यथा स्वभावतः खानि मृणालेषु बिसेषु च ।।धमनीनां तथा खानि रसो यैरुपचीयते ।।

सु.शा.९/१०

As by nature, there is hallow space within lotus stalk and steam, *Dhamani* also have similar channelized space by which *Rasa* is received and circulated[29].

हन्वोरुभयतोऽष्टावष्टौ, तासां तु सन्धिधमन्यौ द्वे द्वे परिहरेत्

सु.शा.७/२२

On each side of jaw (Temporomandibular joint) eigth *Sira* present of which *Sandhidhamani* two on each side are *Avedhya Sira*[30].

Here also we can understand that *Dhamani* word is used for *Avedhya Sira*. It means *Dhamani* means a type of *Sira*.

***Siravyadha Vidhi*:**

In *Shodhan* therapy *Raktmokshan* has been explained as one of the types of *Panchkarma* procedure, under which *Siravedha* is being one of the effective methods explained by *Sushruta* for the letting of blood outside the body.

***Siravyadha Yogya*:**

All *Raktapradoshaja Vyadhi*.[31]

Siravyadha Ayogya Purusha*[32]*:

बालस्थविररूक्षक्षतक्षीणभीरुपरिश्रान्तमद्यपाध्वस्त्रीकर्शितवमितविरिक्तास्थापितानुवासितजागरितक्लीबकृशगर्भिणीनां कासश्वासशोषप्रवृद्धज्वराक्षेपकपक्षाघातोपवासपिपासामूर्च्छाप्रपीडितानां च सिरां न विध्येत्, याश्चाव्यध्याः, व्यध्याश्चादृष्टाः, दृष्टाश्चायन्त्रिताः, यन्त्रिताश्चानुत्थिता इति ।।

सु.शा.८/३

Bal	*Vrudha*	*Ruksha Shariryukta*	*Ksheen*
Parishrramita	*Madyapeeta*	*Krusha*	*Panchkarma neyojita*
Klaibya	*Garbhini*	*Kasa*	*Shwas*
Shosha	*Jwara*	*Akshepa*	*Pakshaghata*
Murcha	*Trusha*	*Anashan*	

So also, those veins which are prohibited from puncturing, which are invisible though indicated for puncturing, which are visible but not controlled, which are not raised(engorged by pressure from a tourniquet etc.) though controlled (such veins should not be punctured).

Siravyadha Kala:

व्यभ्रे वर्षासु विध्येत्तु ग्रीष्मकाले तु शीतले ।।
हेमन्तकाले मध्याह्ने शस्त्रकालास्त्रयः स्मृताः ।।

सु.शा.८/१०

In auspicious day, when the environment is not too cold too hot, especially *Sheetkala* is recommended for *Siravedha*. So *Varsharutu* when there are no clouds, *Greeshmarutu* when there is cold environment and *Hemantrutu* at *Madhyahnakala* are recommended as *Siravedhya kala*[33].

***Upakarana Siddhata*:**

According to *Sthan* different instruments are used for *Siravedha.*

मांसलेष्ववकाशेषु यवमात्रं शस्त्रं निदध्यात्, अतोऽन्यथाऽर्धयवमात्रं
व्रीहिमात्रं वा व्रीहिमुखेन, अस्थ्नामुपरि कुठारिकया विध्येदर्धयवमात्रम् ।।

सु.शा.८/९

1. ***Vrihimukha Shastra (Yavmatra)*:** If *Sira* are in *mansal pradesh*, this *Vrihimukh shastra* is used for *Siravedha* (puncturing should be of the size of the *yava*). Other than *Mansal Pradesh*, ½ *Yavamatra* or 1 *Vrihi* (rice) be punctured size using a *Vrihimukha shastra*.

2. ***Kutarika*:** If *Sira* is over bones should be punctured to the size of half *Yava*, using a *Kutharika.* (as deep as half barely grain)[34].

***Aatur Siddhata*:**

तत्र स्निग्धस्विन्नमातुरं यथादोषप्रत्यनीकं द्रवप्रायमन्नं भुक्तवन्तं यवागूं पीतवन्तं वा यथाकालमुपस्थाप्यासीनं स्थितं वा प्राणानबाधमानो वस्त्रपट्टचर्मान्तर्वल्कललतानामन्यतमेन यन्त्रयित्वा नातिगाढं नातिशिथिलं शरीरप्रदेशमासाद्य यथोक्तं शस्त्रं गृहीत्वा सिरां विध्येत् ।।

सु.शा.८/६

The patient is made *Yogya* to *Siravedha* prior to the process. He is given internally *Sneha*, externally *Abhyanga* and *Sarvanga swedana*. After which patient is fed with curd mixed diet, *Yavagu, Jangal Mansaras* to cause *Utklesha* in *Raktadhatu* so that it comes out devoid of any hindrance, should be asked to sit or stand comfortably. Then after fixing with anyone of cloth, skin, inner bark and creeper and selecting area of the body, neither too hard nor too loose should puncture the *Sira* with proper instrument[35].

Position of patients during *Siravedhya*:

तत्र व्यध्यसिरं पुरुषं प्रत्यादित्यमुखमरत्निमात्रोच्छ्रिते उपवेश्यासने सक्थ्नोराकुञ्चितयोर्निवेश्यकूर्परे सन्धिद्वयस्योपरि हस्तावन्तर्गूढाङ्गुष्ठकृतमुष्टी मन्ययोः स्थापयित्वा यन्त्रणशाटकं ग्रीवामुष्ट्योरुपरिपरिक्षिप्यान्येन पुरुषेण पश्चात्स्थितेन वामहस्तेनोत्तानेन शाटकान्तद्वयं ग्राहयित्वा ततो ब्रूयात् - दक्षिणहस्तेन सिरोत्थापनार्थं नात्यायतशिथिलं यन्त्रमावेष्टयेति, असृक्- स्रावणार्थं च यन्त्रं पृष्ठमध्ये पीडयेति, कर्मपुरुषं च वायुपूर्णमुखं स्थापयेत्, एष उत्तमाङ्गगतानामन्तर्मुखवर्जानां सिराणां व्यधने यन्त्रणविधिः । पादव्यध्यसिरस्य पादं समे स्थाने सुस्थिरं स्थापयित्वाऽन्यं पादमीषत्संकुचितमुच्चैः कृत्वा व्यध्यसिरं पादं जानुसन्धेरधः शाटकेनावेष्ट्य हस्ताभ्यां प्रपीड्य गुल्फं व्यध्यप्रदेशस्योपरि चतुरङ्गुले प्लीतादीनामन्यतमेन बद्ध्वा वा पादसिरां विध्येत् । अथोपरिष्टाद्धस्तौ गूढाङ्गुष्ठकृतमुष्टी सम्यगासने स्थापयित्वा सुखोपविष्टस्य पूर्ववद्यन्त्रं बद्ध्वा हस्तसिरां विध्येत् । गृध्रसीविश्वाच्योः सङ्कुचितजानुकूर्परस्य । श्रोणिपृष्ठस्कन्धेषून्नामितपृष्ठस्यावाक्शिरस्कस्योपविष्टस्य विस्फूर्जितपृष्ठस्य विध्येत् । उदरोरसोः प्रसारितोरस्कस्योन्नामितशिरस्कस्य विस्फूर्जितदेहस्य । बाहुभ्यामवलम्बमानदेहस्य पार्श्वयोः । अनामितमेढ्रस्य मेढ्रे । उन्नमितविदष्टजिह्वाग्रस्याधोजिह्वायाम् । अतिव्यात्ताननस्य तालुनि दन्तमूलेषु च । एवं यन्त्रोपायानन्यांश्च सिरोत्थापनहेतून् बुद्ध्याऽवेक्ष्य शरीरवशेन व्याधिवशेन च विदध्यात् ।।

सु.शा.८/८

The person whose vein has to be punctured should sit facing the sun, on a seat cubit high with his legs flexed, elbows put on knee joints and hands with closed fists placed on neck region. An assistant standing hold of two ends of the cloth by supinated left hand, then he should be asked to tie it, not too tight or too loose, with the right hand for elevating the vein and to press on the centre of the back of the bandage in order to induce blood to flow, meanwhile the patient should stay with mouth filled by air. This is the method of stabilising in case of the puncture of veins situated in head except oral cavity.

In *Siravedha* of legs patient should be in sitting position with one leg stretched where *Siravedha* is going to be done and another slightly flexed. Leg is tied to prevent vibrations and to make the *Sira* to become prominent at the time of blood letting *Gulfasthana* should be gently massaged.

Thumb is held inside the wrist and in suitable position *Hastagata Siravedha* is done.

For *Prushtgata Siravedha,* back should be in erect position.

In *Grudhrasi* and *Vishvachi*, the vein is punctured while patient flexes his knee or elbow respectively.

In case of abdomen and thorax, the chest should be expanded, head raised and the body extended.

In sides, venepuncture should be done while arms are hanging down.

In penis, vein should be punctured while (erect) penis is bent.

Vein in the lower surface of tongue should be punctured while raising the tongue and keeping it steadfast with teeth.

Venepuncture should be performed in palate and gums by opening the mouth wide[36].

***Samyak Siravyadha Lakshan*:**

सम्यक् शस्त्रनिपातेन धारया या स्रवेदसृक् ।।
मुहूर्तं रुद्धा तिष्ठेच्च सुविद्धां तां विनिर्दिशेत् ।।११।।
यथा कुसुम्भपुष्पेभ्यः पूर्वं स्रवति पीतिका ।।
तथा सिरासु विद्धासु दुष्टमग्रे प्रवर्तते ।।१२।।

सु.शा.८/११,१२

As the aim of *Siravedha* is to let out vitiated blood, just after *Siravedha Dushit Rakta* is only coming out as yellowish liquid comes out where *Kusumbha Pushpa* is punctured.
Automatic stoppage of blood after certain time is an indication of "*Samyak Siravyadha*" and it is also indicates that complete vitiated blood is expelled out[37].

Swabhav* of *Sira:

सिरासु शिक्षितो नास्ति चला ह्येताः स्वभावतः ।।
मत्स्यवत् परिवर्तन्ते तस्माद्यत्नेन ताडयेत् ।।

सु.शा.८/२०

Nobody is confidently trained in *Sira* as they are unsteady by nature and change their position like fish. Hence these should be dealt carefully[38].

Sushrutokta Sites for Siravedha:

Sushruta has mentioned total 26 sites for *Siravedha* in different *Vyadhi*.[39]

S.N.	*Vyadhi*[39]	*Sushrutokta* sitse for *Siravedha*[39]
1	*Paadadaha, paadharsha, chippa, visarpa, vatkantak, vicharchika, padadari* etc.	*2 Angula* above *Kshipra Marma* by *Vrihimukha*
2	*Shlipada*	*4 Angula* above or below *gulpha*
3	*Kroshtukashirsha, Khanja, pangu, vatvedana*	*4 Angula* above *Gulpha*
4	*Apachi*	*2 Angula* below *Indrabasti*
5	*Grudhrasi*	*4 Angula* above or below *Janu*
6	*Galganda*	*Sira* of *Urumula*
7	*PlihaVriddhi*	Inner side *of Karpura Sandhi (*at the centre of *vaama-Bahu* OR at middle of left *Kanistika and Anamika*
8	*Yakrutadakhya*	Inner side *of Karpura Sandhi (*at the centre of *Dakshina-Bahu* OR at middle of right *Kanistika and Anamika*
9	*Kasa – Shvasa*	Inner side *of Karpura Sandhi*(at the centre of *Dakshina-Bahu* OR at middle of right *Kanistika and Anamika*
10	*Vishvachi*	*4 Angula Pradesh* above or below *Kurpar Sandhi*
11	*Shulayukta Pravahika*	2 *Angula* nearby *Shroni*
12	*Parivartika, Updamsha, Shukadosa, diseases of Shukra*	Middle *of Shishna*
13	*Mutravriddhi*	*Parshava of Vrishana*
14	*Jalodar*	Leftto *sevani* located 4 *Angula* below umbilicus
15	*Antar-Vidradhi and Parshva-Shula*	At centre of *Kaksha and Stana* at left *Vaama-Parshva*
16	*Bahushosha and Avabahuka*	Inbetween 2 *Ansa*
17	*Tritiyaka Jvara*	*Madhya Sira of Trika Sandhi*[40]
18	*Chaturthaka Jvara*	*Sira* of either right or left *Parshwa* located below *Skandh Sandhi*
19	*Apasmara*	Middle of *HanuSandhi*
20	*Unmada*	*Sira* of *Shankha and Keshanta Shandhi*. Also *Sira* of *ura, Apanga, lalat*
21	*JivhaandDantaroga*	*Sira* below *Jivha*
22	*TaluRoga*	*Talu*
23	*Karna Shula andKarna Roga*	Above and around the *karna*
24	*Nasa Roga*	*Agrabhaga* of *Nasa*
25	*Timira, Akshipaka, Netraroga*	Near by *Nasa, lalat,* at *apang*
26	*Shiroroga, Adhimantha*	Near by *Nasa, lalat,* at *apang*

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B) MODERN LITERATURE REVIEW:-

CARDIOVASCULAR AND LYMPHATIC SYSTEMS

GENERAL ORGANIZATION:[1]

Cells of peripheral blood, suspended in plasma, circulate through the body in the blood vascular system. Interstitial fluid from peripheral tissues returns to the blood vascular system via the lymphatic system, which also provides a channel for the migration of leukocytes and the absorption of certain nutrients from the gut.

The cardiovascular system carries nutrients, oxygen, hormones, etc. throughout the body and the blood redistributes and disperses heat. Blood circulates within a fast, high capacity system made up of the heart, which is the central pump and main motor of the system; **arteries, which lead away from the heart and carry the blood to the peripheral parts of the body; and veins, which return the blood to the heart.** The heart can be thought of as a pair of muscular pumps, one feeding a minor loop (pulmonary circulation), which serves the lungs and oxygenates the blood, the other feeding a major loop (systemic circulation), which serves the rest of the body.

From the centre to the periphery, the vascular tree shows three main modifications. The arteries increase in number by repeated bifurcation and by sending out side branches, in both the systemic and the pulmonary circulation. For example, the aorta, which carries blood from the heart to the systemic circulation, gives rise to about 4 × 106 arterioles and four times as many capillaries. The arteries also decrease in diameter, although not to the same extent as their increase in number, so that a hypothetical cross-section of all the vessels at a given distance will increase in total area with increasing distance from the heart. At its emergence from the heart, the aorta of an adult man has an outer diameter of approximately 30 mm (cross-sectional area of nearly 7 cm2). The diameter decreases along the arterial tree until it is as little as 10 μm in arterioles (each with a cross-sectional area of about 80 μm2). However, given the enormous number of arterioles, the total cross sectional area at this level is approximately 150 cm2, more than 200 times that of the aorta. **As a result, blood flow is faster near the heart than at the periphery.**

The walls of arteries decrease in thickness towards the periphery, although this is not as substantial as the reduction in vessel diameter. Consequently, in the smallest arteries (arterioles), the thickness of the wall represents about half the outer radius of the vessel, whereas in a large vessel it represents between one-fifteenth and one-fifth, e.g. in the thoracic aorta the radius is approximately 17 mm and the wall thickness 1.1 mm.

Venules, which return blood from the periphery, converge on each other forming a progressively smaller number of veins of increasingly large size. As with arteries, the hypothetical total cross-sectional area of all veins at a given level reduces nearer to the heart. Eventually, only the two largest veins, the superior and inferior venae cavae, open into the heart from the systemic circulation. A similar pattern is found in the pulmonary circulation, but here the vascular loop is shorter and has fewer branch points, and consequently, the number of vessels is smaller than in the systemic circulation. The total end-to-end length of the vascular network in a typical adult is twice the circumference of the earth.

The close association between the larger arteries and veins in the limbs allows the counter flow exchange of heat to take place.

Arteries and veins are named primarily according to their anatomical position. In functional terms, **three main classes of vessel are described:** resistance vessels (arteries, but mainly arterioles), exchange vessels (capillaries, sinusoids and small venules) and capacitance vessels (veins). **Structurally, arteries can also be divided into elastic and muscular types.** Although muscle cells and elastic tissue are present in all arteries, the relative amount of elastic material is greatest in the largest vessels, whereas the relative amount of smooth muscle increases progressively towards the smallest arteries.

Arteries may also be subdivided into conducting and distributing, as well as resistance, vessels. The large conducting arteries which arise from the heart, together with their main branches, are characterized by the predominantly elastic properties of their walls. Distributing vessels are smaller arteries supplying the individual organs, and their wall is characterized by a well-developed muscular component. Resistance vessels are mainly arterioles. Small and muscular, they provide the main source of the peripheral resistance to blood fl ow, and they cause a marked drop in the pressure of blood which fl ows into the capillary beds within tissues.

Capillaries, sinusoids and small (post capillary) venules are collectively termed exchange vessels. Their walls allow exchange between blood and the interstitial tissue fluid which surrounds all cells: this is the essential function of a circulatory system. Arterioles, capillaries and venules constitute the micro vascular bed, the structural basis of the microcirculation.

Larger venules and veins form an extensive, but variable, large volume, low-pressure system of vessels conveying blood back to the heart[1].

General features of vessel walls:

Blood vessels, irrespective of size, and with the exception of capillaries and venules, have walls consisting of three concentric layers (tunicae). The intima **(tunica intima),** is the innermost layer. Its main component, the endothelium, lines the entire vascular tree, including the heart, and the lymphatic vessels. The media **(tunica media)** is made of muscle tissue, elastic fibres and collagen. While it is by far the thickest layer in arteries, the media is absent in capillaries and is comparatively thin in veins. The adventitia **(tunica adventitia)** is the outer coat of the vessel, and consists of connective tissue, nerves and vessel capillaries (vasa vasorum). It links the vessels to the surrounding tissues. Vessels differ in the relative thicknesses and detailed compositions of their layers and, in the smallest vessels, the number of layers represented[2].

Large elastic arteries:

The aorta and its largest branches (brachiocephalic, common carotid, subclavian and common iliac arteries) are large elastic arteries which conduct blood to the medium-sized distributing arteries.

The intima is made of an endothelium, resting on a basal lamina, and a subendothelial connective tissue layer.

A prominent internal elastic lamina, sometimes split, lies between intima and media. The adventitia is well developed. In addition to collagen and elastic fibres, it contains flattened fibroblasts with extremely long, thin processes, macrophages and mast cells, nerve bundles and lymphatic vessels. The vasa vasorum are usually confined to the adventitia[3].

Muscular arteries:

Muscular arteries are characterized by the predominance of smooth muscle in the media (Fig. 6.8). The intima consists of an endothelium, similar to that of elastic arteries, which rests on a basal lamina and subendothelial connective tissue. The internal elastic lamina (Fig. is a distinct, thin layer, sometimes duplicated and occasionally absent. It is thrown into wavy folds as a result of contraction of smooth muscle in the media. Some 75% of the mass of the media consists of smooth muscle cells which run spirally or circumferentially around the vessel wall. The adventitia is made of fibroblastic connective tissue, and can be as thick as the media in the smaller arteries. The miner part of the adventitia contains more elastic than collagen fibers4.

Arterioles:

In arterioles the endothelial cells are smaller than in large arteries, but their nuclear region is thicker and often projects markedly into the lumen. Arteriolar adventitia is very thin. Arterioles are usually densely innervated by sympathetic fibres, via small bundles of varicose axons packed with transmitter vesicles, mostly of the adrenergic type[5].

Capillaries:

The capillary wall is formed by an endothelium and its basal lamina, plus a few isolated pericytes. Capillaries are the vessels closest to the tissue they supply and their wall is a minimal barrier between blood and the surrounding tissues. Capillary structure varies in different locations. Capillaries measure 4–8 μm in diameter (much more in the case of sinusoids) and are hundreds of microns long. Their lumen is just large enough to admit the passage of single blood cells, usually with considerable deformation. However, the true bottleneck of the circulatory system occurs at the level of the arterioles, where muscle contraction can obliterate the lumen[6].

Sinusoids:

Sinusoids are expanded capillaries, and are large and irregular in shape. They have true discontinuities in their walls, allowing intimate contact between blood and the parenchyma. The discontinuities are formed by gaps between endothelial cells, which are also fenestrated, such that the sinusoidal lining, and sometimes also the basal lamina, is incomplete. Sinusoids occur in large numbers in the liver (where a basal lamina is completely absent), spleen, bone marrow, adenohypophysis and suprarenal medulla[7].

Venules:

When two or more capillaries converge, the resulting vessel is larger (10–30 μm) and is known as a venule (post capillary venule). Venules (Fig. 6.9) are essentially tubes of fl at, oval or polygonal endothelial cells surrounded by basal lamina and, in the larger vessels, by a delicate adventitia of a few fibroblasts and collagen fi bres mainly running longitudinally. Pericytes support the walls of these venules.

Venules and veins are capacitance vessels, i.e. they have thin distensible walls which can hold a large volume of blood and accommodate luminal pressure changes[8].

Veins:[9]

Veins are characterized by a relatively thin wall in comparison to arteries of similar size and by a large capacitance. Wall thickness is not correlated exactly to the size of the vein, and varies in different regions, e.g. the wall is thicker in veins of the leg than it is in veins of a similar size in the arm.

The structural plan of the wall is similar to that of other vessels, except that the amount of muscle is considerably less than in arteries, while collagen and, in some veins, elastic fibres, predominate. In most veins, e.g. those of the limbs, the muscle is arranged approximately circularly. Longitudinal muscle is present in the iliac, brachiocephalic, portal and renal veins and in the superior and inferior venae cavae. Muscular tissue is absent in the maternal placental veins, dural venous sinuses and pial and retinal veins, veins of trabecular bone and the venous spaces of erectile tissue. These veins consist of endothelium supported by variable amounts of connective tissue. Distinction between the media and adventitial layers is often difficult, and a discrete internal elastic lamina is absent.

Tethering of some veins to connective tissue fasciae and other surrounding tissues may prevent collapse of the vessel even under negative pressure. Pressure within the venous system does not normally exceed 5 mmHg, and it decreases as the veins grow larger and fewer in number, approaching zero close to the heart. Because they contain only a small amount of muscle, veins have limited influence on blood flow. However, during a sudden fall in blood pressure, e.g. following a haemorrhage, elastic recoil and refl ex constriction in veins compensate for the blood loss and tend to maintain venous return to the heart. Vasoconstriction in cutaneous veins in response to cooling is important in thermoregulation.

Most veins have valves to prevent reflux of blood. A valve is formed by an inward projection of the intima, strength strengthened by collagen and elastic fibres, and covered by endothelium which differs in orientation on its two surfaces. Surfaces facing the vessel wall have transversely arranged endothelial cells, whereas on the luminal surface of the valve, over which the main stream of blood fl ows, cells are arranged longitudinally in the direction of flow. Most commonly two, or occasionally three, valves lie opposite one another, sometimes only one is present. They are found in small veins or where tributaries join larger veins. The valves are semilunar (cusps) and attached by their convex edges to the venous wall. Their concave margins are directed with the flow and lie against the wall as long as flow is towards the heart. When blood flow reverses, the valves close and blood fills an expanded region of the wall, a sinus, on the cardiac side of the closed valve. This may give a 'knotted' (varicose) appearance to the distended veins, if these have many valves. In the

limbs, especially the legs where venous return is against gravity, valves are of great importance to venous flow. Blood is moved towards the heart by the intermittent pressure produced by contractions of the surrounding muscles. Valves are absent in veins of the thorax and abdomen[9].

FUNCTIONAL MICROSTRUCTURE OF VESSELS[10]

Intima:

The intimal lining of blood vessels consists of an endothelium, and an variable amount of subendothelial connective tissue, depending on the vessel.

Endothelium:

The endothelium is a monolayer of fl attended polygonal cells which extends continuously over the luminal surface of the entire vascular tree.

Subendothelial connective tissue:

The subendothelial connective tissue, also termed the lamina propria, is a thin but variable layer. It is largely absent in the smallest vessels, where the endothelium is supported instead by pericytes. It contains a typical fibrocollagenous extracellular matrix, a few fibroblasts and occasional smooth muscle cells. Endothelial von Willebr and factor concentrates in this layer and participates in the clotting process when the overlying endothelium is damaged.

Media:

The media consists chiefly of concentric layers of circumferentially or helically arranged smooth muscle cells with variable amounts of elastin and collagen.

Smooth muscle

Smooth muscle forms most of the media of arteries and arterioles. A thinner layer of smooth muscle is also found in venules and veins, with the exception of small segments of the pulmonary veins, where striated cardiac muscle is present in the portions nearest to the heart. Contraction of the smooth muscle in arteries and arterioles reduces the calibre of the vessel lumen, which reduces blood flow through the vessel and raises the pressure on the proximal side. This role is particularly effective in small resistance vessels where the wall is thick, relative to the diameter of the vessel. Smooth muscle can also alter the rigidity of the wall, without causing constriction (isometric contraction), and this affects the distensibility of the wall and propagation of the pulse.

The smooth muscle cells synthesize and secrete elastin, collagen and other extracellular components of the media which bear directly on the mechanical properties of the vessels. The

mechanics of the musculature of the media are complex. Distensibility, strength, self-support, elasticity, rigidity, concentric constriction etc., are interrelated functions and are finely balanced in the different regions of the vascular bed.

In large arteries, where the blood pressure is high, the muscle cells are shorter (60–200 μm) and smaller in volume than in visceral muscle. In arterioles and veins, smooth muscle cells more closely resemble visceral muscle cells. The cells are packed with myofilaments and other elements of the cytoskeleton, including intermediate fi laments. Vascular muscle cells have intermediate fi laments of either vimentin alone or both vimentin and desmin; the intermediate filaments of visceral smooth muscle are exclusively of desmin. Intercellular junctions are mainly of the adhesive (adherens) type and provide mechanical coupling between the cells. In addition, there are gap (communicating) junctions which couple cells electrically. Junctions between muscle cells and the connective tissue matrix are particularly numerous, especially in arteries.

The muscle cells of the arterial media can be regarded as multifunctional mesenchymal cells. After damage to the endothelium, muscle cells migrate into the intima and proliferate, forming bundles of longitudinally oriented cells which reform the layer. In certain pathological conditions, muscle cells (and macrophages) undergo fatty degeneration and participate in the formation of atheromatous plaques.

Collagen and elastin

Components of the extracellular matrix are major constituents of vessel walls, and in large arteries and veins they make up more than half of the mass of the wall, mainly in the form of collagen and elastin. Other fibrous components such as fibronectin, and amorphous proteoglycans and glycosaminoglycans, are present in the interstitial space.

Adventitia:

The adventitia is formed of general connective tissue, varying in the thickness and density of its collagen fibre bundles.

Vasa vasorum

In smaller vessels, the nourishment of the tissues of the vessel wall is provided by diffusion from the blood circulating in the vessel itself. Large vessels have their own vascular supply within the adventitia, in the form of a network of small vessels, mainly of the microcirculation, which are called the vasa vasorum. The wall thickness at which simple diffusion from the lumen becomes insufficient is1 mm.

The vasa vasorum originate from, and drain into, adjacent vessels which are peripheral branches of the vessel they supply. They ramify within the adventitia and, in the largest of arteries, penetrate the outermost part of the media. The larger veins are also supplied by vasavasorum, but these may penetrate the wall more deeply, perhaps because of the lower oxygen tension.

Nervi vasorum

Blood vessels are innervated by efferent autonomic fibres which regulate the state of contraction of the musculature (muscular tone), and thus the diameter of the vessels, particularly the arteries and arterioles. These perivascular nerves branch and anastomose within the adventitia of an artery, forming a meshwork around it. In some of the large muscular arteries, nerves are occasionally found within the outermost layers of the media[10].

LYMPHATIC VESSELS:[11]

Lymphatic capillaries form wide-meshed plexuses in the extra cellular matrices of most tissues. They begin as dilated, blind-ended tubes with larger diameters and less regular cross-sectional appearances than those of blood capillaries. A basal lamina is incomplete or absent and they lack associated pericytes. The smaller lymphatic vessels are lined by endothelial cells, which have numerous transcytotic vesicles within their cytoplasm, and so resemble blood capillaries. However, unlike capillaries, their endothelium is generally quite permeable to much larger molecules: they are readily permeable to large colloidal proteins and particulate material such as cell debris and microorganisms, and also to cells. Permeability is facilitated by gaps between the endothelial cells, which lack tight junctions, and by pinocytosis.

Lymph is formed from interstitial fluid, which is derived from blood plasma via the microcirculation. Much of this fluid is returned to the venous system.

In most tissues, lymph is clear and colourless. In contrast, the lymph from the small intestine is dense and milky, reflecting the presence of lipid droplets (chylomicrons) derived from fat absorbed by the mucosal epithelium.

In the larger vessels, a thin external connective tissue coat supports the endothelium. The largest lymphatic vessels (200 □m) have three layers, like small veins, although their lumen is considerably larger than is the case in veins with a similar wall thickness.

The larger lymphatic vessels differ from small veins in having many more valves. The valves are semilunar, generally paired and composed of an extension of the intima. Their edges point

in the direction of the current, and the vessel wall downstream is expanded into a sinus, which gives the vessels a beaded appearance when they are distended. Valves are important in preventing the backflow of lymph.

Lymphatic vessels repair easily and new vessels readily form after damage[11].

CHARACTERISTIC FEATURES OF BLOOD VESSELS:

1. Arteries are thick –walled, being uniformly thicker than the accompanying veins, except for the arteries within the cranium and vertebral canal where these are thin.
2. Their lumen is smaller than that of the accompanying veins.
3. Arteries have no valves.
4. An artery as usually accompanied by vein (s) and nerve(s), and the three of them together forms the neurovascular bundle which is surrounded and supported by a fibroareolar sheath[12].

Formation of Blood Vessels (Embryology):

Formation of blood vessels and blood cells is first seen in the wall of the yolk sac around allantoic diverticulum and in the connecting stalk. In these situations, clusters of mesodermal cells aggregate to form blood islands. These mesodermal cells are then converted to precursor cells (haemangioblasts) which give rise to blood vessels and blood cells. Cells which are present in the centre of blood is land, form precursors of blood cells (haematopoietic stem cells) Cells at periphery of island form the precursors of blood vessels. (angioblasts). [12]

Structural study of vessels: Generally all blood vessels have three coats.

1**.** Outer – Tunica adventitia.

2. Middle – Tunica media and

3. Inner – Tunica intima

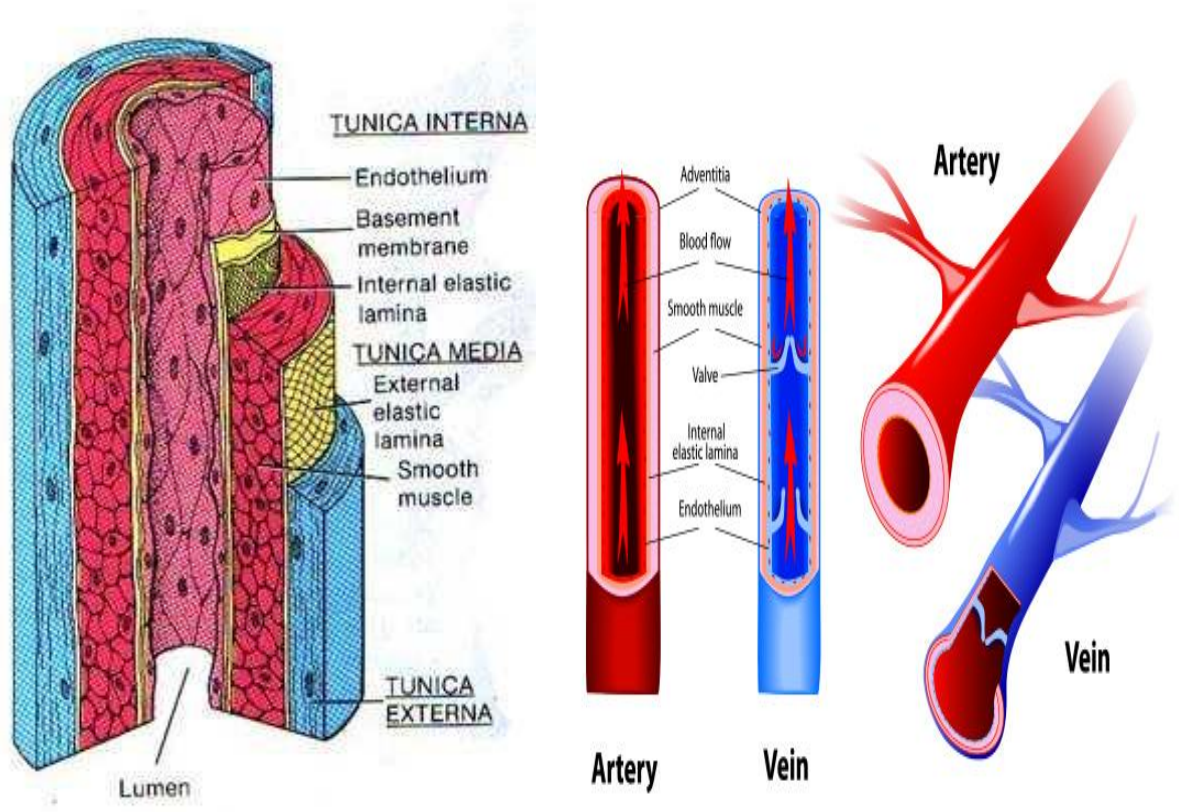

Fig: <u>Structural features of the large blood vessels</u>

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2. Susan Standring, (40th Edition, 2008), Gray's Anatomy, Churchill Livingstone Elsevier-London, Chapter- 6, Pg- 131.

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10. Susan Standring, (40th Edition, 2008), Gray's Anatomy, Churchill Livingstone Elsevier-London, Chapter- 6, Pg- 135, 136, 137, 138.

11. Susan Standring, (40th Edition, 2008), Gray's Anatomy, Churchill Livingstone Elsevier-London, Chapter- 6, Pg- 139.

12. Dr. Sachin Patil., (2013), "Study of Raktavaha Sira with special reference to peripheral arterial disease of lower extremities", M.D Dessertation, B.V.D.U.University,Pune. Pg.16, 28.

MATERIALS

1. Ayurvedic Literature: Bhrihadtrayee-
    a) Sushruta Samhita
    b) Charak Samhita
    c) Ashtang Sangraha and Ashtang Hrudya

2. Modern Literature:
    a) Gray's Anatomy
    b) Cunninghams Manual of Practical Anatomy
    c) B.D. Chaurasia's Human Anatomy
    d) Tortora – Principales of Anatomy and Physiology

3. Questionnaire-A - To identify *Siravedha* practicing *Vaidyas*. (See Annexure II)

4. Questionnaire-B -To collect information from *Siravedha* practicing *Vaidyas*.
    a) Questionnaire- B-1 for Confirmatory Sites of *Vedhya Sira* (See Annexure III)
    b) Questionnaire- B-2 for Confirmatory Sites of *Avedhya Sira* (See Annexure III)

5. Documents of Post mortem Case Report - Post mortem case reports were studied at Sasoon Hospital, Pune but those were not available due to confidentiality of medico-legal cases.

METHODS

The study plan at a glance:

A. Conceptual study

1. Comparison of *Sira* with Vessels
2. Theoretical Interpretation of *Vedhya Sira*
3. Theoretical Interpretation of *Avedhya Sira*
4. Relation between *Avedhya Sira* and *Sira Marma*

B. Survey study

1. Preparation of Questionnaire A, B-1 and B-2.
2. Survey of *Siravedha* practicing *Vaidyas*- all over India

C. Retrospective study of Documented Post mortem Case report

- Case study of 306 Postmortem cases – The cases of injuries leading to death was studied on the basis of Postmortem findings noted regarding damage to single structure i.e. either artery or vein.

A) CONCEPTUAL STUDY:

1. Comparison of *Sira* with Vessels:

a) Functions of *Sira* and vessels:

i) Function of *Sira*:

सप्त सिराशतानि भवन्ति, याभिरिदं शरीरमाराम इव जलहारिणीभिः केदार इव च कुल्याभिरुपस्निह्यतेऽनुगृह्यते चाकुञ्चनप्रसारणादिभिर्विशेषैः, द्रुमपत्रसेवनीनामिव तासां प्रतानाः, तासां नाभिर्मूलं, ततश्च प्रसरन्त्यूर्ध्वमधस्तिर्यक् च ।।

सु.शा.७/३

The body is nourished by 700 *Sira* like garden by water-carriers and like field by irrigating channels and also benefitted with activities such as contraction, extension etc. Their ramifications are as venation in a leaf; their root is umbilicus where from they spread upwards, downwards and obliquely.[1]

ii) Function of Vessels:

According to modern science, there are many tubule like structures in human body called as vessels (artery, vein, capillary and lymphatics). These vessels nourish the body. (The nutrients, oxygen, hormones, etc. are carried out throughout the body by cardiovascular system through vessels[2].)

b) Types of *Sira* and vessels:

i) Types of *Sira*:

***Sira* are classified into 4 types according to *Dosha*.**

तत्रारुणा वातवहाः पूर्यन्ते वायुना सिराः ।।
पित्तादुष्णाश्च नीलाश्च, शीता गौर्यः स्थिराः कफात्
असृग्वहास्तु रोहिण्यः सिरा नात्युष्णशीतलाः ।।

सु.शा.७/१८

1. *Vatavahi*
2. *Pittavahi*
3. *Kaphavahi*
4. *Raktavahi*

Vatavahi Sira (Aruna) are blackish red in colour and filled with *Vata*, *Pittavahi Sira (Neela)* are warm and blue in colour, *Kaphavahi Sira (Gauri)* are cold, white and stable, *Raktavahi Sira (Rohini)* are red in colour and neither very hot nor very cold[3].

ii) Types of Vessels:

There are 4 types of vessels:

Arteries - These are Brick red in colour[4], having thick walls and run from heart to other parts of the body, carrying oxygenated blood[5].

Veins – These are Blue in colour[4] with thin walls and run towards heart from other parts of the body, carrying deoxygenated blood[6].

Capillaries - Blackish red in colour[7], having thin walls and run towards heart carrying deoxygenated blood[8].

Lymphatics - White/colourless, having thin walls and run towards heart, carrying lymph.[9]

Comparison of types of *Sira*[3] with types of vessels (On the basis of colour)[4,7,9]:

S.N.	***Ayurveda***	**Modern**
1	***Aruna (Vatavahi)***	**Capillary**
	Convey *Vata dosha*. Blackish red in colour. Minute, if pressed suddenly get emptied and after removing pressure suddenly fill.	Convey deoxygenated blood. Blackish red in appearance. Minute, if pressed suddenly emptied and after removing pressure suddenly fill.
2	***Neela (Pittavahi)***	**Vein**
	Convey *Pitta dosha*. Blue in appearance and are warm.	Convey deoxygenated blood. Blue in appearance.
3	***Gauri (Kaphavahi*)**	**Lymph vessel**
	Convey *Kapha dosha*. White in colour. Steady, sheet and nutritive.	Convey lymph. White or colourless. They are nutritive, cold and beaded.
4	***Rohini (Raktavahi)***	**Artery**
	Convey Suddha Rakta. Red in colour. Neither warm nor cold.	Convey oxygenated blood and nutritive. Red in appearance.

2. Theoretical Interpretation of *Vedhya Sira*:

The *Vedhya Sira* are explained with following points for each *Vyadhi*.

i) Sutra in Devnagari

ii) Translation in English

iii) Site with justification

iv) Structures at considered site

v) Interpretation

1. <u>*Adhoshakha* - sites of *Siravedha*[10]</u>:

- ***Padadaha, Padharsha, Chippa, Visarpra, Vatkantak, Vicharchika, and Padadari etc.***

i) *Sutra* in devnagari: तत्र पाददाहपादहर्षचिप्पविसर्पवातशोणितवातकण्टकविचर्चिकापाददारीप्रभृतिषु **क्षिप्रमर्मण उपरिष्टाद् द्व्यङ्गुले** व्रीहिमुखेन शिरां विध्येत् ... । **सु.शा.८/१७**

ii) Translation: In diseases like *Padadaha, Padharsha, Chippa, Visarpra, Vatkantak, Vicharchika, and Padadari etc.*, the vein situated two *angula* above the *Kshipra Marma* should be punctured using *Vrihimukha*.

iii) Site with justification: Site of *Kshipra Marma*[11]is in between great toe and first little toe (at the distal part of the first metatarsal space). Here we considered dorsal aspect of foot because here subcutaneous veins are easily seen than the planter aspect. Two *angula* above *Kshipra Marma* this site is a space between 1st and 2nd metatarsal bone.

iv) Structures at considered site: When we see this site, here tributaries of great saphenous veins are present. Great saphenous vein begin from medial end of the dorsal venous arch and runs upwards and backwards anterior to the medial malleolus[12].

v) Interpretation: So as per the above context in all said diseases, medial end of the dorsal venous arch i.e. beginning of great saphenous vein can be considered for *Siravedha*, which coincides with the site 2 *angula* above *Kshipra Marma*.(See Fig. 1.A. On page 45)

- ***Shlipad:***

i) Sutra* in *devnagari: स्नेहस्वेदोपपन्ने तु श्लीपदेऽनिलजे भिषक् ।।
कृत्वा गुल्फोपरि सिरां विध्येत्तु चतुरङ्गुले ।।
गुल्फस्याधः सिरां विध्येच्छ्लीपदे पित्तसंभवे ।। सु.चि.१९/५२, ५३ ,५४

ii) Transalation: In *Vataj Shlipad* the surgeon should puncture the vein 4 *angula,* above and in *Pittaj Shlipad* 4 angula below the *Gulpha Sandhi* (ankle joint)[13].

iii) Site with justification: Here we have to consider that lateral and medial aspect of leg and foot respectively for above and below the *Gulpha Sandhi*. Lateral aspect of leg is bulky due to multiple muscles but medial aspect is subcutaneous shows dominant vein unlike lateral aspect. Same scenario is observed regarding dorsum of foot. So 4 *angula* above from the ankle joint considered medial aspect of leg, and 4 angula below considered medial border of dorsum of the foot. Because here prominent veins are easily seen than the other aspects.

iv) Structures at considered site: 4 *angula* below ankle joint is beginning of great saphenous vein and above 4 *angula* from ankle joint here also great saphenous vein on the medial aspect of leg[12].

v) Interpretation: So in *Vataj Shlipad* 4 *angula* above the *Gulpha*, and in *Pittaj Shlipad* 4 *angula* below *Gulpha,* great saphenous vein can be considered (punctured) for *Siravedha*. (See Fig. 1.A. On page 45)

- ***Krostukashirsha, Khanja, Pangu* and *Vatvedana*:**

***i) Sutra* in devnagari:** यथा वक्ष्यते क्रोष्टुकशिरःखञ्जपङ्गुलवातवेदनासु **जङ्घायां गुल्फस्योपरि चतुरङ्गुले,..** ।
सु.शा.८/१७

ii) Translation: In *Krostukashirsha, Khanja, Pangu,* and *Vatvedana*, *Siravedha* should be done in *Jangha*, at 4 *angula* above the *Gulpha* (ankle joint).

iii) Site with justification: Here we have to consider that lateral and medial aspect of leg above the *Gulpha Sandhi.* Lateral aspect of leg is bulky due to multiple muscles but medial aspect is subcutaneous shows dominant vein. So we considered medial aspect of leg, because here prominent veins are easily seen.

iv) Structures at considered site: On the medial aspect of leg 4 *angula* above from ankle joint is great saphenous vein[12].

v) Interpretation: So in above said *Vyadhi,* we can consider Great saphenous vein for *Siravedha*. (See Fig. 1.A. On page 45)

- ***Apachi* :**

i) *Sutra* in devnagari: अपच्यामिन्द्रबस्तेरधस्ताद् द्व्यङ्गुले, **सु.शा.८/१७**

ii) Translation: In *Apachi, Siravedha* is done at two *angula* below the *Indrabasti Marma.*

iii) Site with justification: Here we have to finalize the site of *Indrabasti Marma. Sushruta* has not specified the site of *Indrabasti Marma.* If we see the treaty of *Dalhanacharya,* he has stated the site of *Indrabasti* is 13 *angula* above the *Parshni*[11] (calcaneum). When we observe this considered site there is bifurcation of popliteal artery (at the lower apex of the popliteal fossa.) injury to this site the symptoms of *Vidha lakshana* of *Indrabasti Marma* is seen, and it is type of *Mansa Marma*. So location of *Indrabasti Marma* is on calf muscles.

iv) Structures at considered site: Here the small saphenous vein is easily visible on back of the leg 2 *angula* below the *Indrabasti Marma*. The small saphenous vein receives many cutaneous tributaries in the leg[14].

v) Interpretation: So small saphenous vein on back of leg 2 *angula* below *Indrabasti* can be considered for *Siravedha* in *Apachi Vyadhi.* (See Fig. 1.B. On page 45)

- ***Grudhrasi*:**

i) *Sutra* in *devnagari*: जानुसन्धेरुपर्यधो वा चतुरङ्गुले गृध्रस्याम्, । **सु.शा.८/१७**

ii) Translation: In *Grudhrasi, Siravedha* should be done 4 *angula* either above or below the *Janu* (Knee joint).

iii) Site with justification: Here, we have to consider four aspect of 4 *angula* above and below knee region. When we see these sites the prominent veins seen only from medial aspect. So we considered medial aspect.

iv) Structures at considered site: The great saphenous vein is easily seen in this site. The vein has several communications through the deep fascia with deep veins[12].

v) Interpretation: So the great saphenous vein 4 *angula* below and above at medial aspect of *Janu Sandhi* can be considered for *Siravedha* in *Grudhrasi Vyadhi*. (See Fig. 1.A. On page 45)

- ***Galaganda*:**

i) *Sutra* in *devnagari*: ऊरुमूलसंश्रितां गलगण्डे एतेनेतरसक्थि बाहू च व्याख्यातौ,। **सु.शा.८/१७**

ii) Translation: In *Galaganda, Siravedha* should be done at the *Urumula Samistha Sira* (root of the thigh) .

iii) Site with justification: Groin region (Inguinal ligament) separates abdomen from thigh. So this part is considered as the root of the lower extremity.

iv) Structures at considered site:

The superficial epigastric vein runs downwards and laterally from umbilicus and drain into femoral vein (great saphenous vein).

The superficial circumflex iliac vein runs downwards from lateral side of the inguinal ligament, it pierces the fascia lata lateral to the saphenous opening, and drains in to femoral vein[15]. (Great saphenous vein)

v) Interpretation: So any of these veins can be considered for *Siravedha* in *Galaganda Vyadhi*. (Veins present in inguinal region). (See Fig. 1.A. On page 45)

Fig. 1 *Adhoshakha* - Interpretative sites of *Vedhya Sira*

Fig. 1.A. Ant. Aspect of Rt. lower extremity

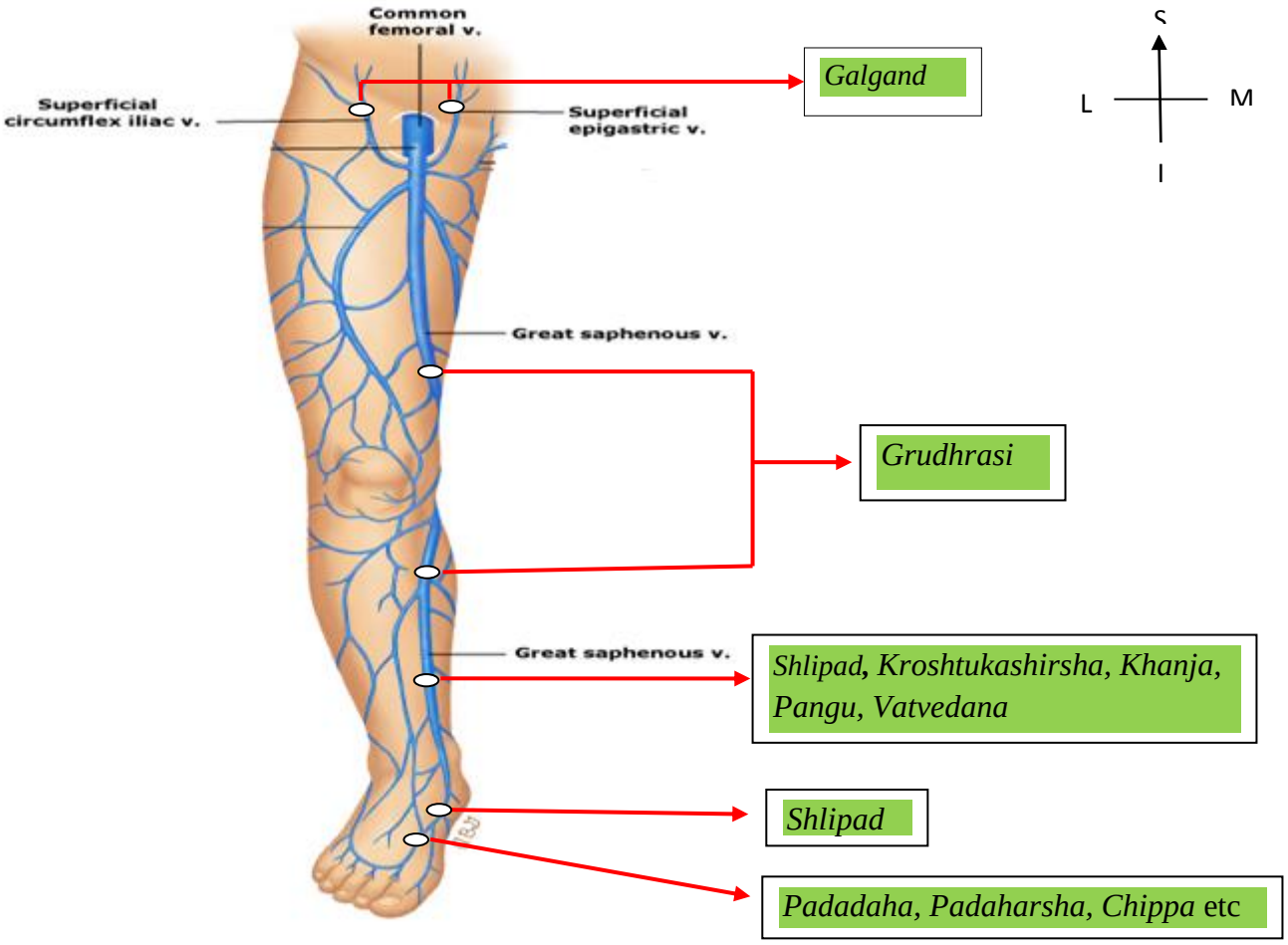
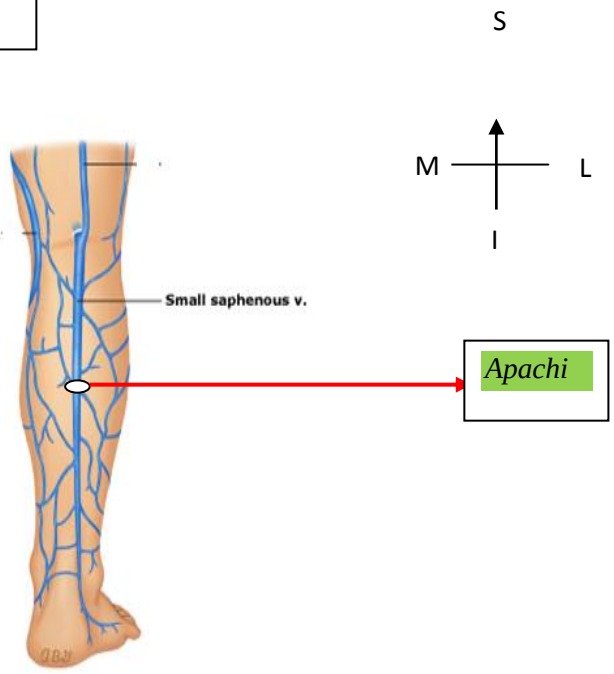


Fig. 1. B. Post. Aspect of Rt. leg



2. *Urdhwashakha*- sites of *Siravedha*[10]:

- ***Pleehodara*:**

i) *Sutra* in *devnagari*: विशेषतस्तु वामबाहौ कूर्परसन्धेरभ्यन्तरतो बाहुमध्ये प्रोह्वि कनिष्ठिकानामिकयोर्मध्ये वा एवं दक्षिणबाहौ यकृदाख्ये (कफोदरे च) । सु.शा.८/१७

ii) Translation: In diseases of *Pleeha*, *Siravedha* should be done especially in the left upper limb at the medial side of *Kurpar Sandhi* (elbow joint) in the centre of the arm or in the area between *Kanistika* and *Anamika* (between the left little and ring fingers).

iii) Site with justification: *Sushruta* told medial aspect of *Kurpar*, in anatomy elbow joint have only anterior and posterior aspect. Hence, here we have considered medial aspect of anterior side of the elbow or in between little and ring finger of left hand.

iv) Structures at considered site: Site 1: At the left elbow joint prominent median cubital veins links cephalic and basilic vein. It receives number of tributaries from the front of forearm and gives off the median vein, which pierces the facial roof of antero-cubital fossa to join the venae commitants of brachial artery. So the vein recommended for *Siravedha* may be median cubital vein of left elbow[16].

Site: 2. Alternative, *Sushruta* has indicated the use of vein situated in between little finger and ring finger may be used for *Siravedha*. As per context, dorsal digital veins from lateral side of the little finger and medial side of the ring finger of left hand can be consider for *Siravedha*[17].

v) Interpretation: In *Pleehodar*, *Siravyadha* can be done at either median cubital vein of the left elbow joint, or left dorsal digital veins in between little and ring fingers of left hand. (See Fig. 2.A and B. On page 48)

- ***Yakrudakhya (Kaphodara)*:**

ii) Translation: In diseases of *Yakrudakhya*, *Siravedha* should be done especially in the right upper limb at the medial side of kurpar *Sandhi* (elbow joint) in the centre of the arm or in the area between *Kanistika and Anamika* (between the right little and ring fingers).

iii) Site with justification: *Sushruta* told medial aspect of Kurpar, in anatomy elbow joint have only anterior and posterior aspect. Hence, here we have considered medial aspect of anterior side of the elbow, or in between little and ring finger of right hand.

iv) Structures at considered site: site 1. At the right elbow joint prominent median cubital veins links cephalic and basilic vein. It receives number of tributaries from the front of forearm and gives off the median vein, which pierces the facial roof of antero-cubital fossa to

join the venae commitants of brachial artery. So the vein recommended for *Siravedha* may be median cubital vein of right elbow[16].

Site: 2. Alternative, *Sushruta* has indicated the use of vein situated in between little finger and ring finger may be used for *Siravedha*. As per context, dorsal digital veins from lateral side of the little finger and medial side of the ring finger of right hand can be consider for *Siravedha*[17].

v) Interpretation: In *Yakrudakhya,* either median cubital vein of the right elbow joint or the right dorsal digital veins in between little and ring fingers of right hand can be used for *Siravedha*. (See Fig. 2.A and B. On page 48)

- ***Kasa- Shwas:***

i) *Sutra* in *devnagari:* एतामेव च कासश्वासयोरप्यादिशन्ति । **सु.शा.८/१७**

Same as *Yakrudakhya*. (See Fig. 2.A and B. On page 48)

- ***Vishvachi:***

i) *Sutra* in *devnagari:* गृध्रस्यामिव विश्वाच्यां । **सु.शा.८/१७**

ii) Translation: In *Vishvachi* pain in the arm will be similar to that of *Grudhrasi*, so *Siravedha* at 4 *Angula* above or below *Kurpara Sandhi* is done.

iii) Site with justification: 4 *Angula* above the *Kurpar* (elbow joint) and 4 *Angula* below the *Kurpar* (elbow joint) on both aspects.

iv) Structures at considered site: 4 *Angula* above from the elbow joint there is one prominent vein i.e. cephalic vein.4 *Angula* below from the elbow joint on both lateral and medial aspect there are two veins. One is cephalic vein and another is basilic.

Cephalic vein that begins from the lateral end of the dorsal venous arch. It runs upwards wind around the lateral border of forearm, continues upwards along the lateral border of biceps. It pierces deep fascia of pectoralis major. It pierces the clavipectoral fascia and joints of axillary veins[18].

Basilic vein which is a post-axial vein of upper limb that begins with the dorsal venous arch runs upwards along the medial border of the fore arm winds around the elbow where it pierces the deep fascia and lastly runs around the medial side of the brachial artery[18].

v) Interpretation: So we can consider these cephalic and basilic veins 4 *Angula* above and below for *Siravedha* in *Vishvachi Vyadhi*.(See Fig. 2.A. On page 48)

Fig. 2 *Urdhwashakha* - Interpretative sites of *Vedhya Sira*

Fig.2.A. Ant. Aspect of Rt. Upper Extremity

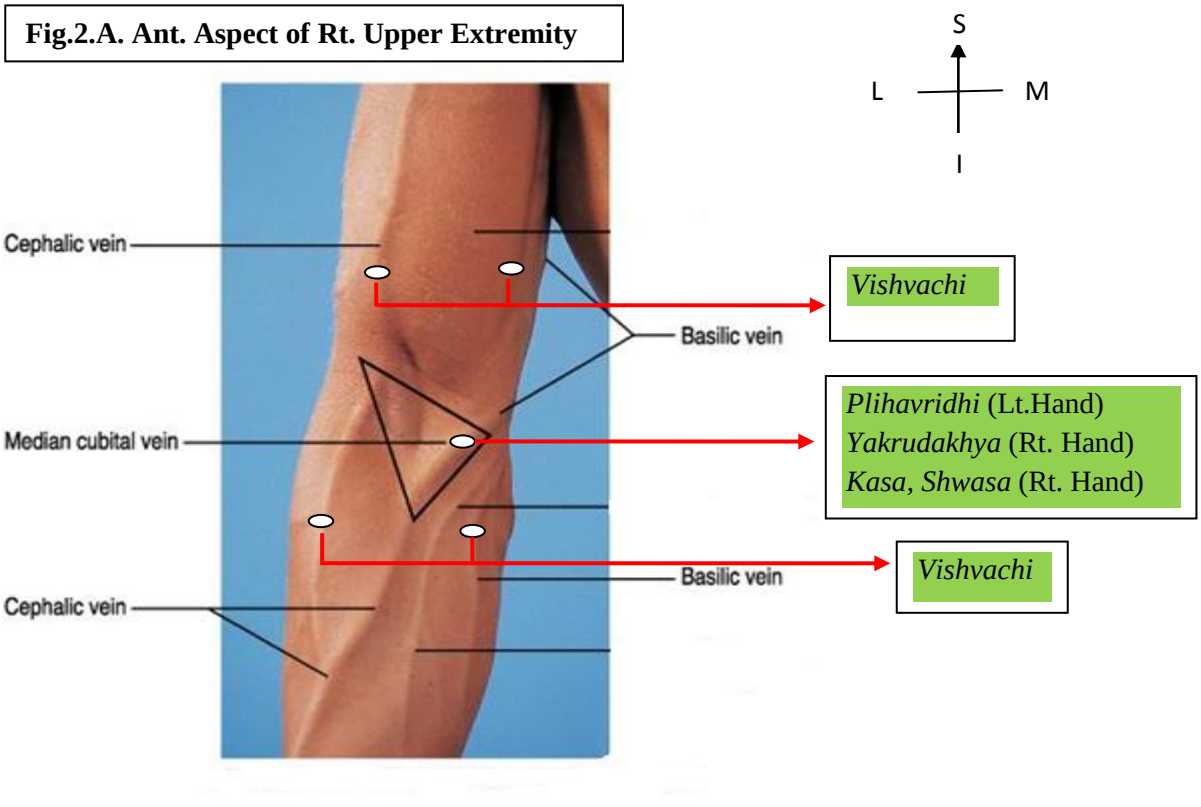
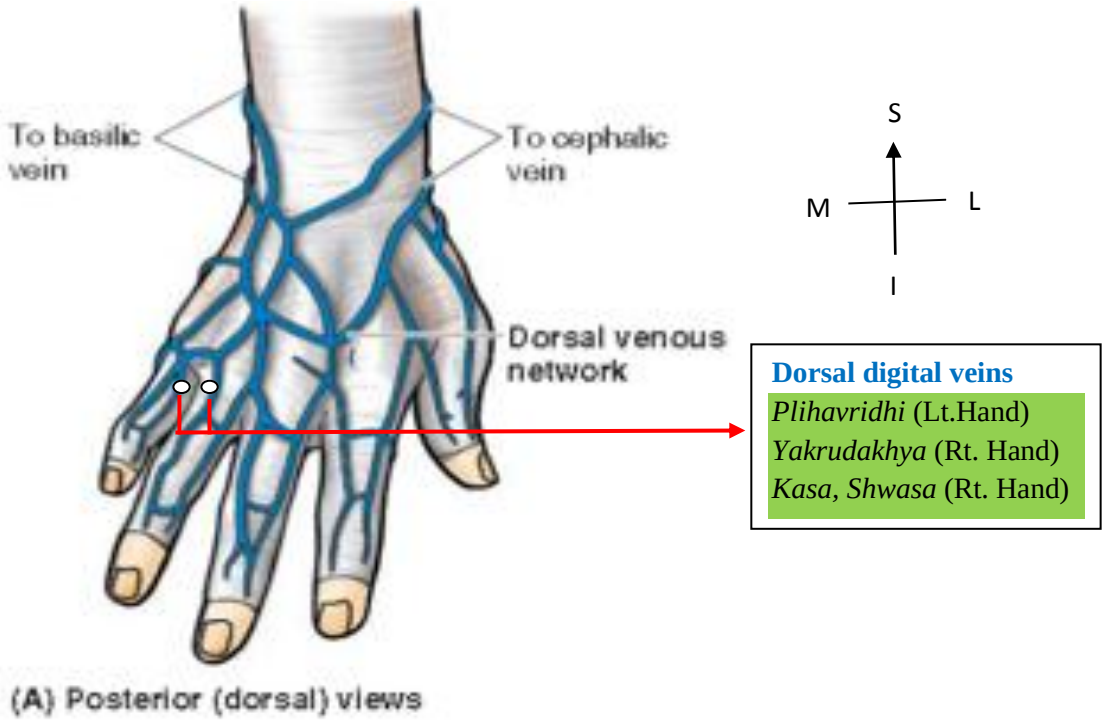


Fig.2.B.Dorsal aspect of Rt. Hand



3. <u>Madhya Sharir - sites of *Siravedha*[10]:</u>

- ***Shulayukta Pravahika*:**

i) *Sutra* in *devnagari:* **श्रोणिं प्रति समन्ताद् द्व्यङ्गुले** प्रवाहिकायां शूलिन्यां। **सु.शा.८/१७**

ii) Translation: *Sira* 2 *Angula* near by *Shroni* should be punctured in *Pravahika Vyadhi.*

iii) Site with justification: Near the hip. (Anteriorly- inguinal region and posteriorly- gluteal region)

iv) Structures at considered site: The superficial epigastric veins runs downwards and laterally from umbilicus and drain into femoral vein. These are the veins of the lower part of the abdomen[15].

The superficial circumflex iliac vein runs downwards from lateral side of the inguinal ligament, it pierces the fascia lata lateral to the saphenous opening, and drains in to femoral vein[15].

The blood supply of the skin and subcutaneous tissue of the gluteal region is derived from perforating branches of the superior and inferior gluteal vessels[19]. (Here considered superior and inferion gluteal veins)

v) Interpretation: So we can puncture any of these veins in *Shulayukta Pravahika* just two angula near *Shroni***.** (See Fig. 3.C. On page 54)

- ***Parivartika, Updamsha, Shukadosa,* Diseases of *Shukra:***

i) *Sutra* in devnagari: परिवर्तिकोपदंशशूकदोषशुक्रव्यापत्सु **मेढ्रमध्ये** । **सु.शा.८/१७**

ii) Translation: In diseases of *Parivartika, Updamsha, Shukdosha* and diseases of *Shukra, Siravedha* should be done especially in the middle of *Shisna*.

iii) Site with justification: Middle of Dorsal aspect of the penis.

iv) Structures at considered site: The superficial dorsal vein of the penis lies in the superficial fascia. (It is visible on the dorsal surface of the penis) It divides into right and left branches which drain in to the superficial external pudendal veins[20].

v) Interpretation: So in *Parivartika, Updamsha, Shukadohsa* and diseases of *Shukra* superficial dorsal vein of the penis can be consider for *Siravedha*. (See Fig. 3.A. On page 53)

- ***Mutravruddhi:***

i) *Sutra* in *devnagari:* **वृषणयोः पार्श्वे** मूत्रवृध्द्यां । **सु.शा.८/१७**

ii) Translation: In *Mutravriddhi, Siravedha* should be done at *Parshwa* of *Vrishna*.

iii) Site with justification: lateral wall of the scrotum.

iv) Structures at considered site: venous drainage of scrotum is through tributaries of superficial external pudendal vein, which drains ultimately into femoral vein[21].

v) Interpretation: So in *Mutravruddhi Vyadi*, tributaries of superficial external pudendal veins can be considered for *Siravedha*. (See Fig. 3.B. On page 53)

- ***Jalodar*:**

i) *Sutra* in *devnagari*: नाभेरधश्चतुरङ्गुले सेवन्या वामपार्श्वे दकोदरे । **सु.शा.८/१७**

ii) Translation: In *Jalodar Siravedha* should be done 4 *Angula* below the umbilicus to the left of *Sevani*.

iii) Site with justification: Left to the median plane (linea alba) and 4 *Angula* below the umbilicus.

iv) Structures at considered site: The superficial epigastric vein runs downwards and laterally on both right and left side from umbilicus drain into femoral vein. These are the veins of the lower part of the abdomen and both veins runs lateral side of the median plane[15] (linea alba) i.e. *Sevani.*

v) Interpretation: So in *Jalodar* the left superficial epigastric vein of left sided only can be considered for *Siravedha* 4 *Angula* below the umbilicus. (See Fig. 3.C. On page 54)

- ***Antar-Vidradhi* and *Parshwa-Shula:***

i) *Sutra* in *devnagari:* वामपार्श्वे कक्षास्तनयोरन्तरेऽन्तर्विद्रधौ पार्श्वशूले च। **सु.शा.८/१७**

ii) Translation: In this *Vyadhi Siravedha* should be done in region between *Kaksha* and *Stana* at left *Vaam-Parshwa*.

iii) Site with justification: Here we considered midpoint between breast and mid axillary line of the left side.

iv) Structures at considered site: When we see the anatomy of lateral wall of thorax (axillary region). We can observe the lateral thoracic vein, which runs in between *Stana* (breast) and *Kaksha* (axilla).

Lateral thoracic vein collects blood from breast, run on lateral border of the pectoralis minor in close relation with the anterior group of axillary lymph nodes[22].

v) Interpretation: So left lateral thoracic vein can be used for *Siravedha* in above *Vyadhis*. (See Fig. 3.C. On page 54)

- ***Bahushosha* and *Avabahuka*:**

i) *Sutra* in *devnagari*: बाहुशोषावबाहुकयोरप्येके **वदन्त्यंसयोरन्तरे ।सु.शा.८/१७**

ii) Translation: In *Bahushosha* and *Avabahuka, Siravedha* should be done at in between *Ansa* region.

iii) Site with justification: बाहुमूर्धग्रीवामध्येंऽसपीठस्कन्धबन्धनावंसौ, तत्र स्तब्धबाहुता, **सु.शा.६/२६**

The site of *Ansa Marma* is between the tip of arm and neck binding *Ansapith* and *Skandha*[23]. Thus the site of *ansa* is superior angle of scapula. With the help of this reference; we have considered site for *Siravedha* is area in between superior angle of scapulae.

iv) Structures at considered site: Superficial branch of the transverse cervical artery accompany veins lie immediately under cover of the trapezius which runs in this site. Superficial branch of transverse cervical vein drains into subclavian vein, tributaries of these veins present over the skin of this region[24].

v) Interpretation: So we can suitably do *Siravedha* at tributaries of superficial branch of transverse cervical vein in *Avabahuka* and *Bahushosha Vyadhi.* (See Fig. 3.E. On page 56)

- ***Tritiyaka Jwara***:

i) *Sutra* in *devnagari:* **त्रिकसन्धिमध्यगतां** तृतीयके । **सु.शा.८/१७**

ii) Translation: In *Tritiyaka Jvara, Siravedha* should be conducted at middle of *Trik Sandhi*.

iii) Site with justification: i) पृष्ठोपरि पृष्ठवंशमुभयतस्त्रिकसंबद्धे अंसफलके, । **सु.शा.६/२६**

While explaining *Ansphalak Marma, Sushruta* mentioned *Trik*[23]**.** *Ansphalaka Marma* is *Asthi Marma* and site of this is root of spine of scapula.

ii) त्रिकेतिअंसयोरन्तर इत्यत्रापि संबध्यते। तेनांसयोरन्तरेयस्त्रिकसन्धिः तत्समीपगतां । **सु.शा.८/१७ (डल्हण टीका)**

According to *Dalhana, Trik* means area in between *Ansa* region[25]. Here अंसयोरन्तरेत्रिकसन्धिः means area in between vertebral column and root of spine of scapula. Thus here we have considered site of *Siravedha* is area in between vertebral column and root of spine of scapula.

iv) Structures at considered site: Dorsal scapular artery (deep branch of transverse cervical artery) along with veins runs on the medial border of scapula and supplies to the muscles and skin present in between vertebral column and medial border of scapula[22].

v) Interpretation: So here we have considered tributaries of dorsal scapular vein for *Siravedha.* (See Fig. 3.F. On page 57)

- ***Chaturthaka Jvara:***

i) *Sutra* in *devnagari*: अधःस्कन्धसन्धिगतामन्यतरपार्श्वसंस्थितां चतुर्थके । **सु.शा.८/१७**

ii) Translation: *Sira* of either right or left *Parshwa* located below *Skandha Sandhi* should be used for *Siravedha* in *Chaturthaka Jvara.*

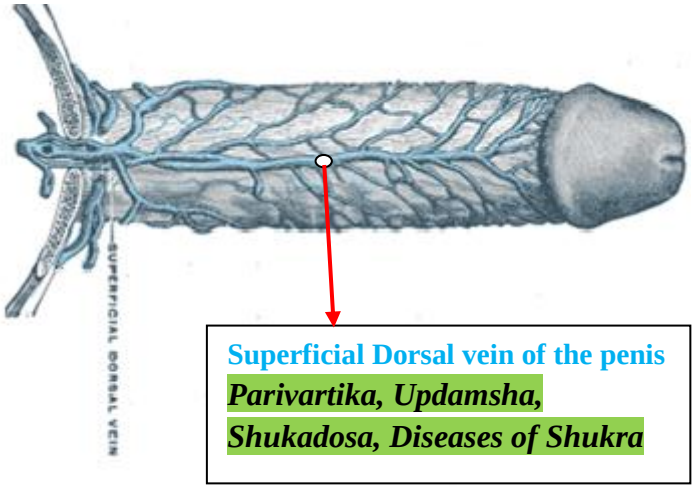
iii) Site with justification: Lateral wall of thorax near mid axillary line.

iv) Structures at considered site: Thoracodorsal vein (Thoraco-Epigastric vein) accompanies thoracodorsal arteries which drain into subscapular vein. This vein runs on the lateral chest wall parallel to the margin of latissimus dorsi together with the thoracodorsal nerve to that muscle[22].

v) Interpretation: So Thoracodorsal vein can be considered for *Siravedha* in *Chaturthaka Jwara*. (See Fig. 3.D. On page 55)

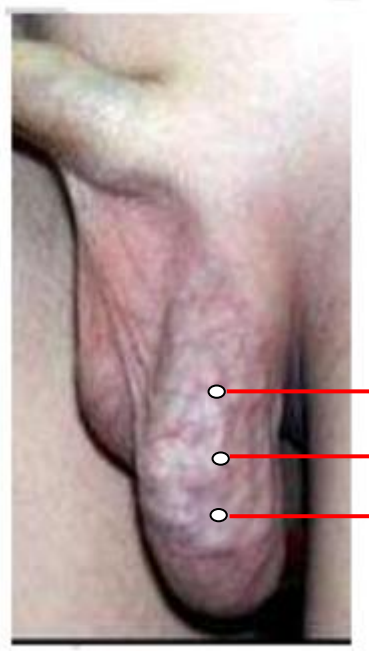
Fig. 3 *Madhyasharir* - Interpretative sites of *Vedhya Sira*

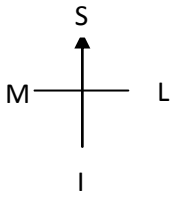
Fig. 3. A. Dorsal aspect of Penis



Superficial Dorsal vein of the penis
Parivartika, Updamsha,
Shukadosa, Diseases of Shukra

Fig. 3. B. Lateral aspect of Left scrotum





Tributaries of Superficial external pudendal vein
Mutravruddhi

Fig. 3. C. Anterior aspect of Thorax and Abdomine

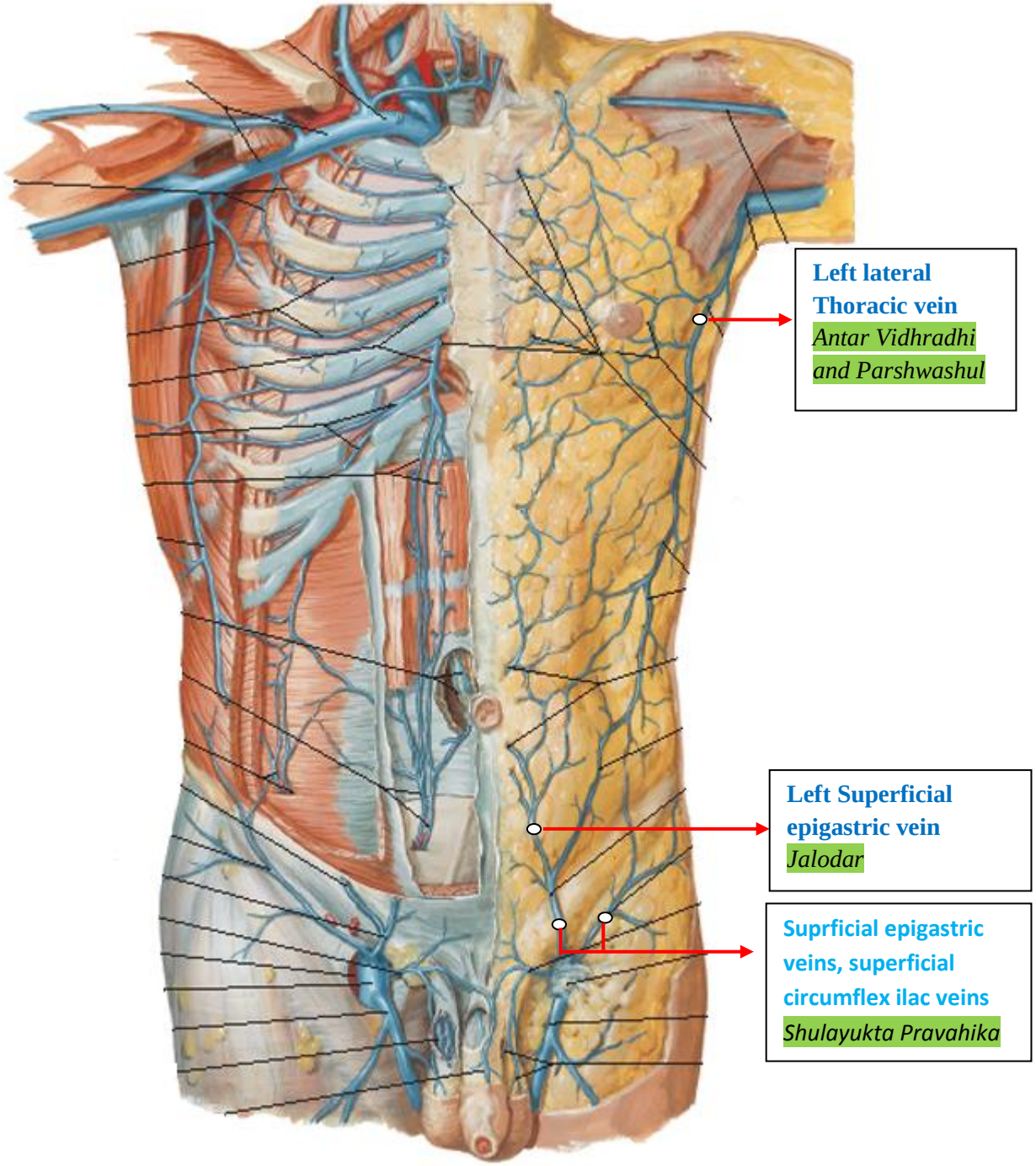


Fig. 3. D. Right Lateral wall of thorax

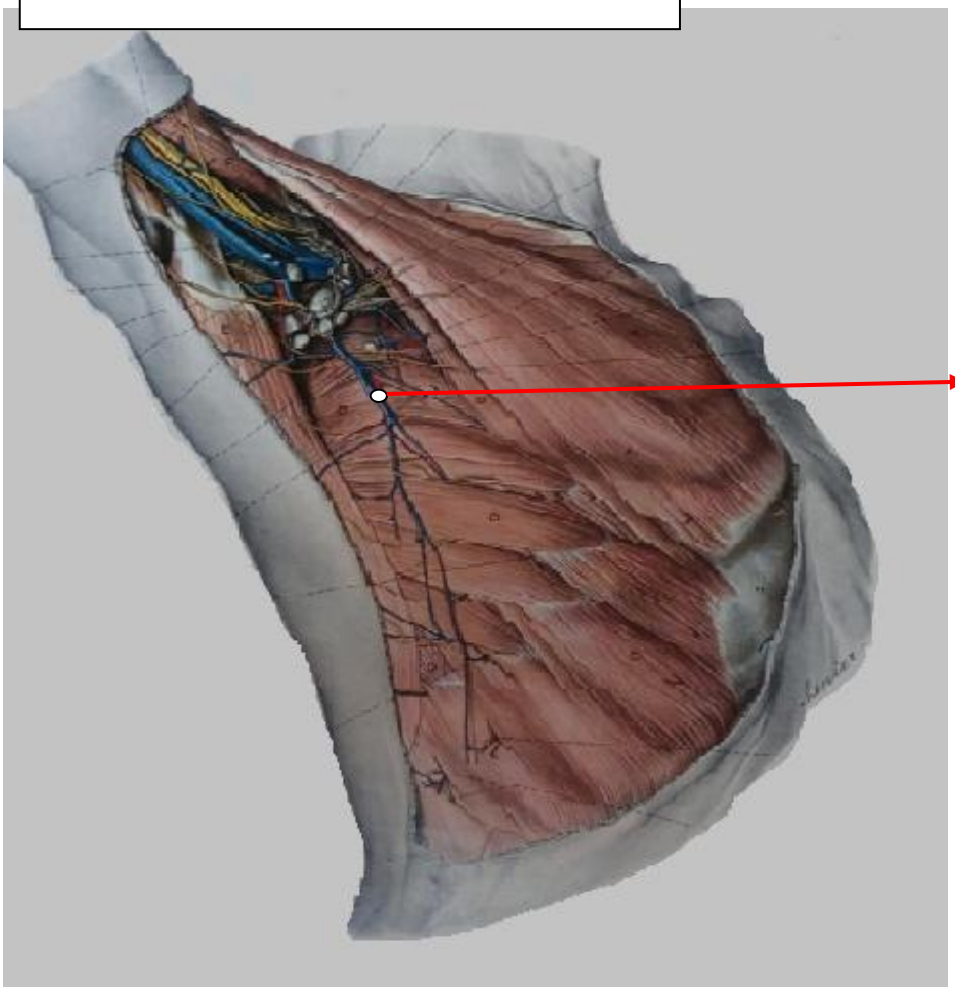
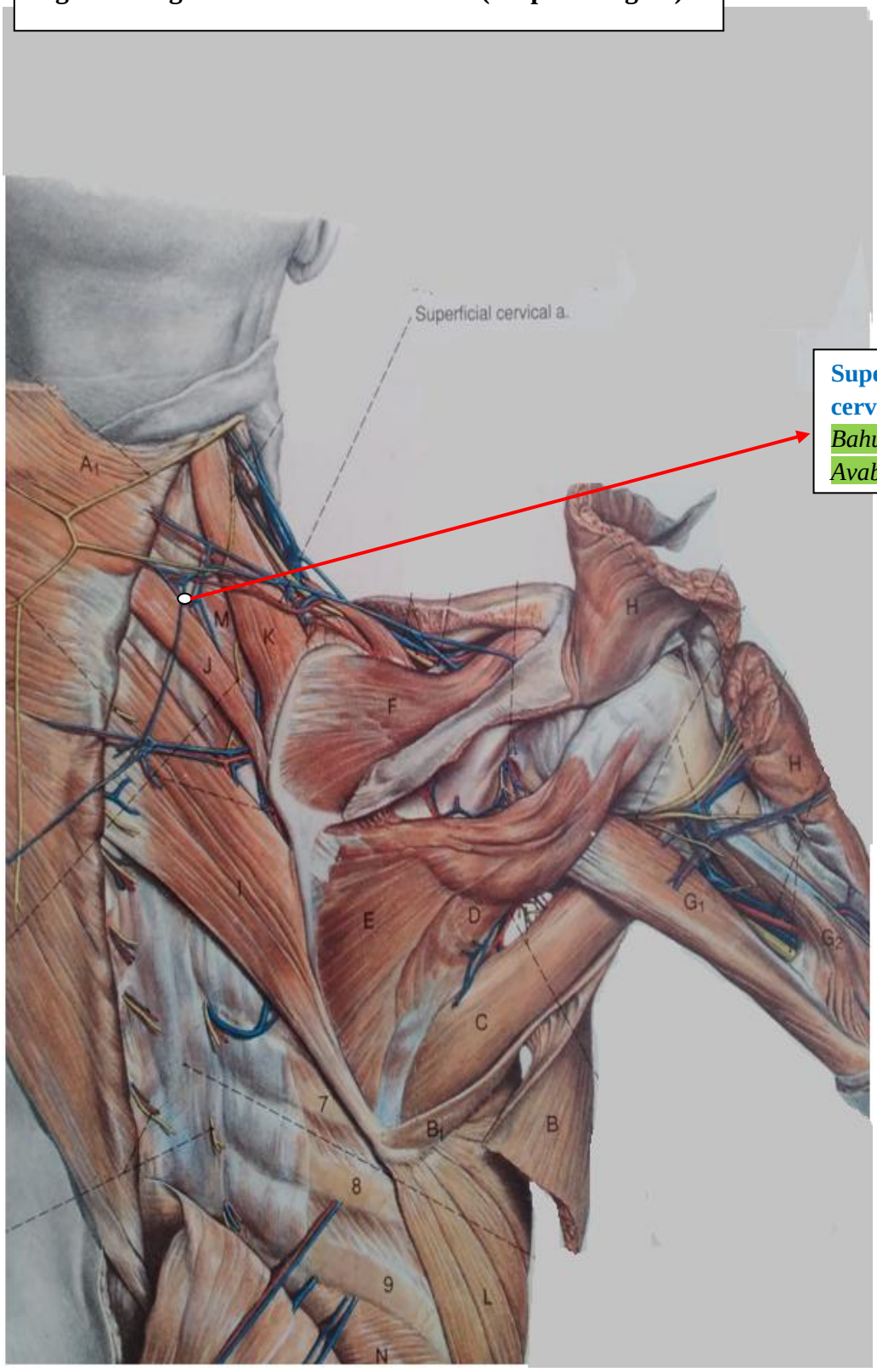
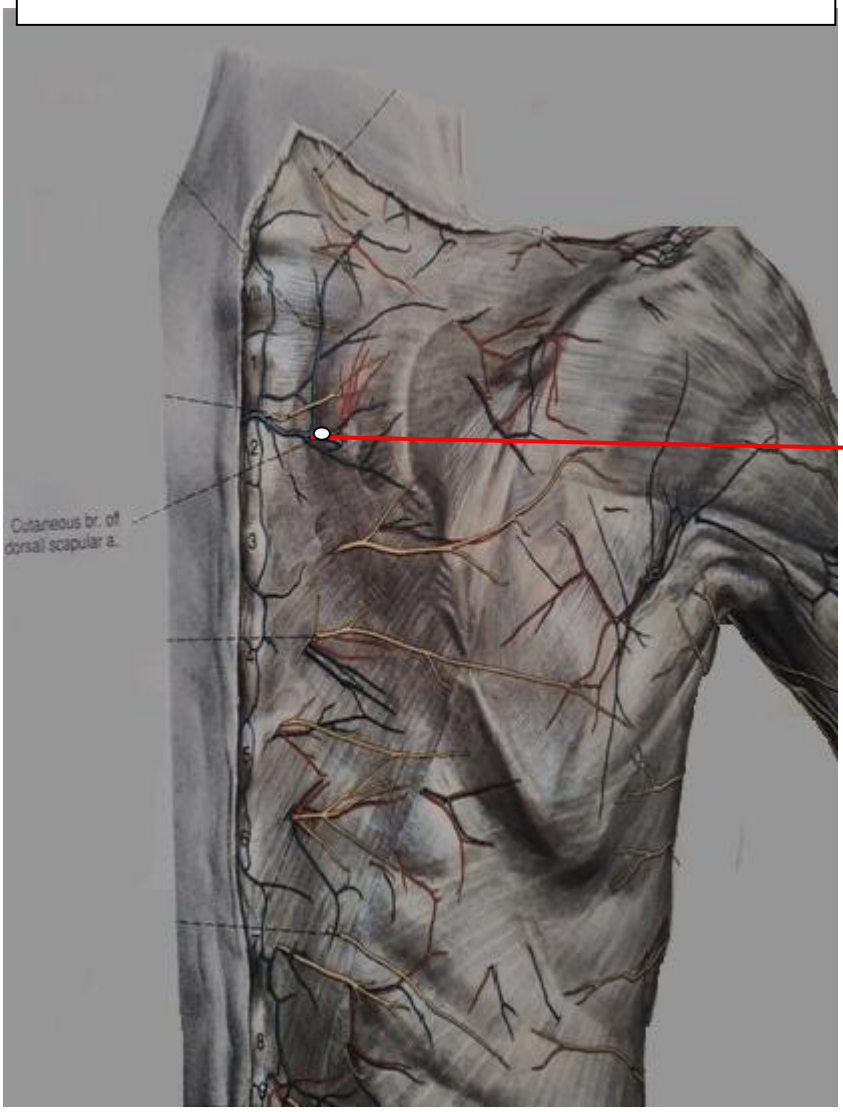


Fig. 3. E. Right side of back of Thorax (Scapular region)



Superficial transverse cervical Vein
Bahushosha and *Avabahuka*

Fig. 3. F. Right side of back of Thorax (Scapular region)



Tributaries of Dorsal scapular vein
Tritiyak Jwar

4. *Urdhwajatru* - sites of *Siravedha*[10]*:*

- ***Apasmara*:**

i) *Sutra* in *devnagari*: हनुसन्धिमध्यगतामपस्मारे । **सु.शा.८/१७**

ii) Translation: In *Apasmara Vyadhi, Sira* in the middle of the *Hanu Sandhi* should be punctured.

iii) Site with justification: हन्विति हनुसन्धिमध्यगतां हनुसमिपसन्धिमध्यगतामित्यर्थः ।

सु.शा.८/१७ (डल्हण टीका)

Middle of the *Sandhi* which is near to the Hanu[26] (Middle of the temporomandibular joint).

iv) Structures at considered site: Transverse facial vein drains into superficial temporal vein, runs downwards crossing the root of the zygoma (pre-auricular point) continuous as retromandibular vein, then it becomes external jugular vein. Transverse facial vein is closely related to the temporomandibular joint[27].

v) Interpretation: So we can consider the transverse facial vein for *Siravedha* in *Apasmara.* (See Fig. 4.B. On page 63)

- ***Unmada:***

i) *Sutra* in *devnagari:* शङ्खकेशान्तसन्धि- गतामुरोऽपाङ्गललाटेषु चोन्मादे । **सु.शा.८/१७**

ii) Translation: *Sira* of *Shankha* and *Keshanta Shandhi* and also *Sira* of *Ura*, *Apanga* and *Lalat* should be punctured in *Unmada Vyadhi*.

iii) Site with justification:

Sira of *Shankha* and *Keshanta Shandhi*- Vein situated in the junction of temples and hair-line.

Sira of *Ura* – veins of chest wall,

Apanga- veins present at outer canthus of eye.

Lalat – veins of forehead

iv) Structures at considered site: *Sira of Shankha* and *Keshanta Shandhi*: The superficial temporal vein runs at the junction of temples and hair lines, which joins the middle temporal vein at the root the zygomatic arch to form the retromandibular vein. Here middle of the superficial temporal vein considered[28].

Sira of *Ura:* When we see the anatomy of lateral wall of thorax (pectoral region). We found the anterior cutaneous veins and the lateral cutaneous veins.

The anterior cutaneous veins drains into internal thoracic vein and the lateral cutaneous branches drain into posterior intercostals veins[29]**.**

Apang: Zyagomatico-orbital veins which drains either into frontal tributaries of superficial temporal vein or into transverse facial vein[30].

Lalat: Anterior (frontal) tributaries of superficial temporal vein run on forehead. The supratrochlear and supraorbital veins unite at the medial angle of the eye (at the root of nose) to form the angular vein[31].

v) Interpretation: So we can consider these above veins for *Siravedha* in *Unmad Vyadhi*. (See Fig. 4.A. On page 62 and Fig. 4.F. On page 65)

- ***Jivha* and *Dantaroga:***

i) *Sutra* in *devnagari*: जिह्वारोगाष्**वधोजिह्वायां** दन्तव्याधिषु च । **सु.शा.८/१७**

ii) Translation: In diseases of *Jivha* and *Dantroga Siravedha* is done below the *Jivha*.

iii) Site with justification: Inferior surface of anterior 2/3 of the tongue.

iv) Structures at considered site: The arrangement of the veins of the tongue on under surface is variable. Two vena comitant accompany the lingual artery, and one vena comitans accompanies the hypoglossal nerve.

The deep lingual vein is the largest and principal vein of the tongue. It is visible on the inferior surface of the tongue. It runs backwards and crosses the genioglossus and hyoglosus (below the hypoglossal nerve)[32].

These veins unite at the posterior border of the hypoglossus to form the lingual vein which drains either in the common facial vein or in the internal jugular vein.

v) Interpretation: The deep lingual vein is prominent and visible. So this vein can be used for *Siravedha* in *Jivha* and *Dantaroga.* (See Fig. 4.C. On page 63)

- ***Talu rog:***

i) *Sutra* in *devnagari*: तालुनि **तालव्येषु** । **सु.शा.८/१७**

ii) Translation: In *Talugat Roga, Siravedha* is done at *Talu*.

iii) Site with justification: Veins of hard palate.

iv) Structures at considered site: Greater palatine veins accompany greater palatine arteries, runs through greater palatine canal and go to the pterygoid plexus of veins. The plexus drain by maxillary vein[33].

v) Interpretation: So in *Talugat Roga*, greater palatine veins can be used for *Siravedha*. (See Fig. 4.D. On page 64)

***Karna Shula* and *Karna Roga*:**

i) *Sutra* in *devnagari*: **कर्णयोरुपरि समन्तात्** कर्णशूले तद्रोगेषु च। **सु.शा.८/१७**

ii) Translation: In *Karna Shula* and *Karnroga*, *Sira* around and above *Karna* should be used for *Siravedha*.

iii) Site with justification: Around and above the ear.

iv) Structures at considered site: The superficial temporal vein joins the middle temporal vein at the root the zygomatic arch to form the retromandibular vein. (These veins runs in front and above ear).[28]

The posterior auricular vein comes from back of the auricle, the skin over the mastoid process, and over the back of the scalp, and drain into external jugular vein. (These veins runs from back and above ear).[28]

v) Interpretation: So superficial temporal vein or posterior auricular vein can be considered for *Siravedha* in *Karnaroga* and *Karnashula.* (See Fig. 4.A. On page 62)

- ***Nasa Roga*:**

i) *Sutra* in *devnagari:* गन्धाग्रहणे नासारोगेषु च **नासाग्रे** । **सु.शा.८/१७**

ii) Translation: *Sira* of *Agrabhaga* of *Nasa* should be used for *Siravedha* in *Nasa Roga*.

iii) Site with justification: Anterior part of the nose.

iv) Structures at considered site: Venous drainage of nasal septum- The veins form a plexus which is more marked in the lower part of the septum (littles area). The plexus drains anteriorly into the facial vein and posteriorly through the sphenopalatine vein to the pterygoid venous plexus.

If we puncture veins of nasal septum, there are chances of excessive bleeding due to damage to little's area. So it should be avoided.

Here we have considered veins present at the anteriorsuperior quadrant of lateral wall of nose.

Venous drainage: The veins form a plexus which drains anteriorly into the facial vein[35].

v) Interpretation: So the veins of lateral wall of the nose at anterio superior part (The veins form a plexus which drains anteriorly into the facial vein) can be used for *Siravedha* in *Nasa Roga*. (See Fig. 4.E. On page 64)

- ***Timira, Akshipaka* etc:**

i) *Sutra* in *devnagari:* तिमिराक्षिपाकप्रभृतिष्वक्ष्याम**येषूपनासिके ललाट्यामापाङ्ग्यां वा,एता एव** शिरोरोगाधिमन्थप्रभृतिषु रोगेष्विति ।। **सु.शा.८/१७**

ii) Translation: In *Timira, Akshipaka* etc. *Netraroga, Sira* which are present at *Upnasika, Lalat* or *Apang* should be punctured.

iii) Site with justification:

Upnasika - near nose.

Lalat – veins of forehead.

Apanga- veins present at outer canthus of eye.

iv) Structures at considered site: The supratrochlear and supraorbital veins[31] *(Lalat)* unite at the medial angle of the eye (at the root of nose) to form the angular vein [36](nearby *Nasa*), then angular vein continuous as facial vein (near *Nasa).*

The frontal branch of superficial temporal vein runs on the forehead[28]. (*Lalat*)

Apang: Zyagomatico-orbital veins (present at outer canthus of eye) which drains either into frontal tributaries of superficial temporal vein, or into transverse facial vein[30].

v) Interpretation: So we can consider these veins for *Siravedha* in above *Vyadhi.* (See Fig. 4.A. On page 62 and Fig. 4.B. On page 63,)

- ***Shiroroga, Adhimantha* etc**:

i) *Sutra* in *devnagari*: तिमिराक्षिपाकप्रभृतिष्वक्ष्याम**येषूपनासिके ललाट्यामापाङ्ग्या** वा,एता एव **शिरोरोगाधिमन्थप्रभृतिषु रोगेष्विति ।।१७।। सु.शा.८/१७**

Translation: In *Shiroroga, Adhimantha etc. Vyadhi, Sira* which are present near by *Nasa*, at *Apang* or *Lalat* should be punctured.

Site with justification, Structures at considered site and Interpretation is same as *Timira, Akshipaka* etc. (See Fig. 4.A. On page 62 and Fig. 4.B. On page 63)

Fig. 4. *Urdhwajatru* - Interpretative sites of *Vedhya Sira:*

Fig. 4. A. Right Lateral aspect of face and Scalp

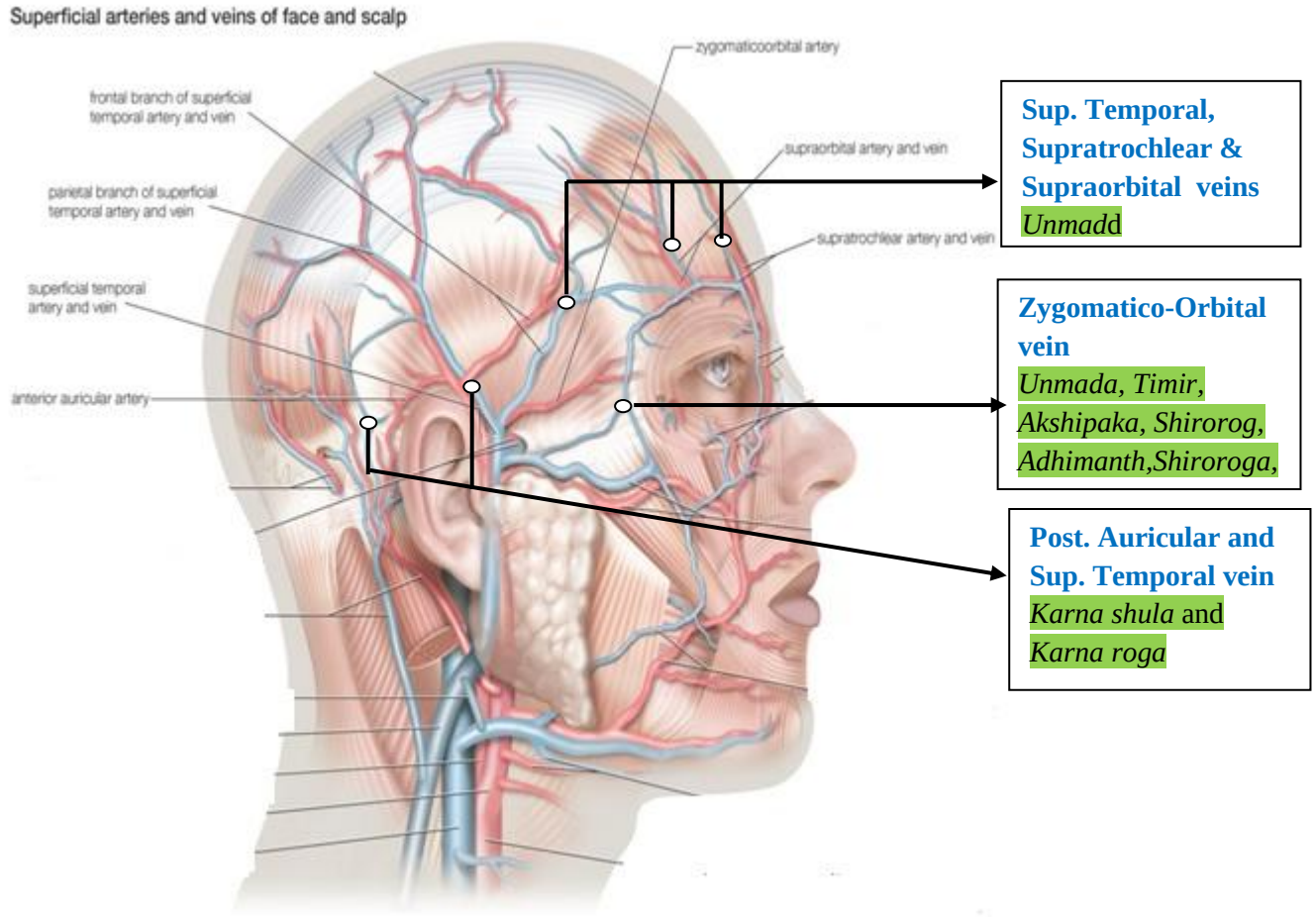
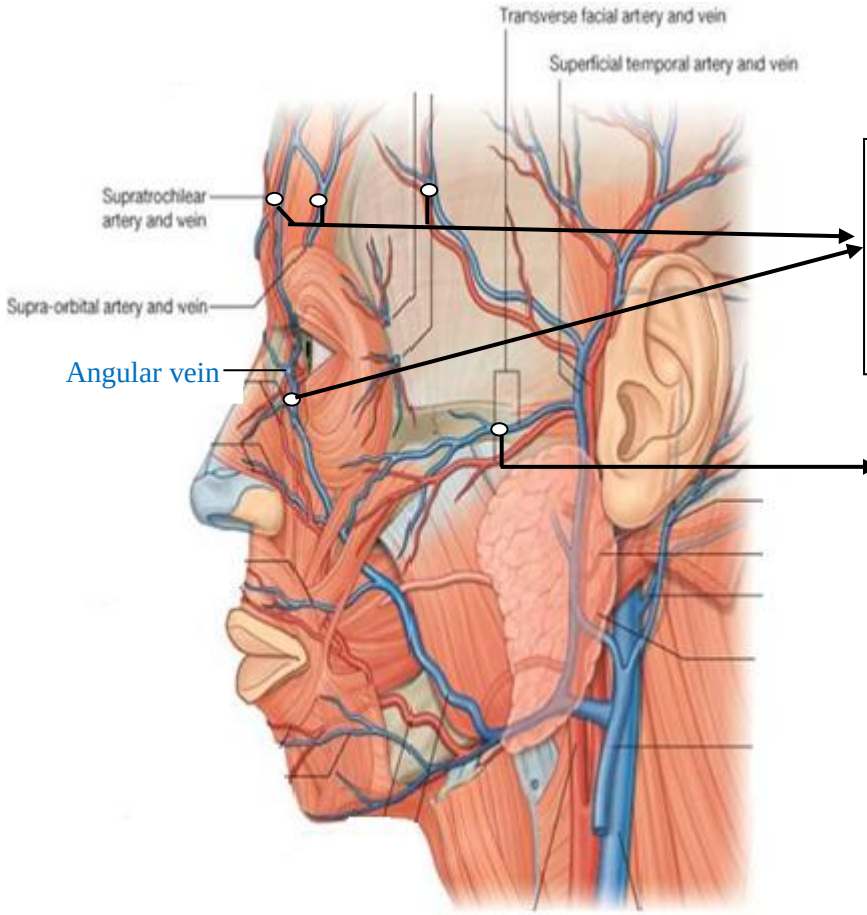


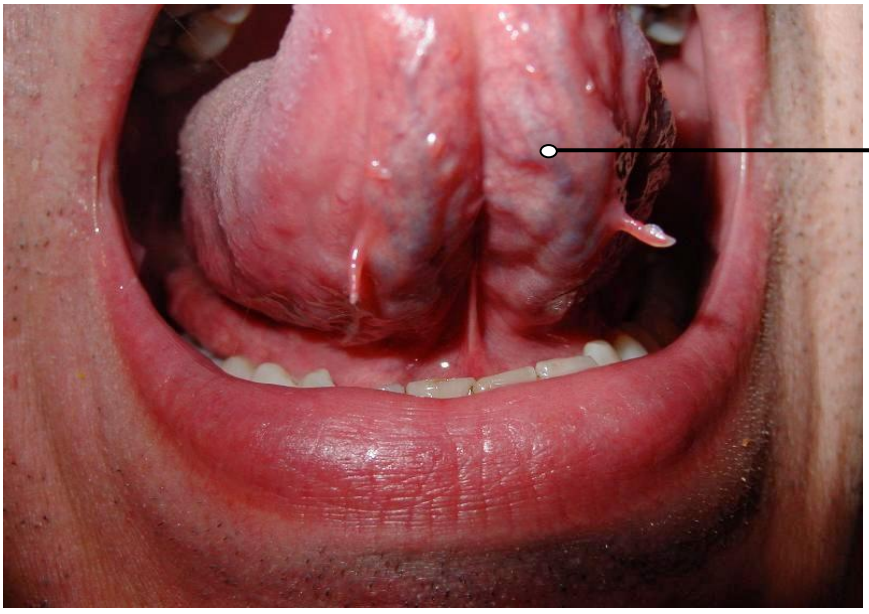
Fig. 4. B. Left Lateral aspect of face



Supratrochlear, Supraorbital vein, Frontal branch of Sup. Temporal Vein and Angular vein
Timir, Akshipaka, Shiroraga, Adhimantha etc

Transverse facial vein
Apasmara

Fig. 4. C. Inferior surface of Tongue



Deep lingual vein
Jivha and *Dantarogra*

Fig.4.D. Hard Palate (Oral aspect)

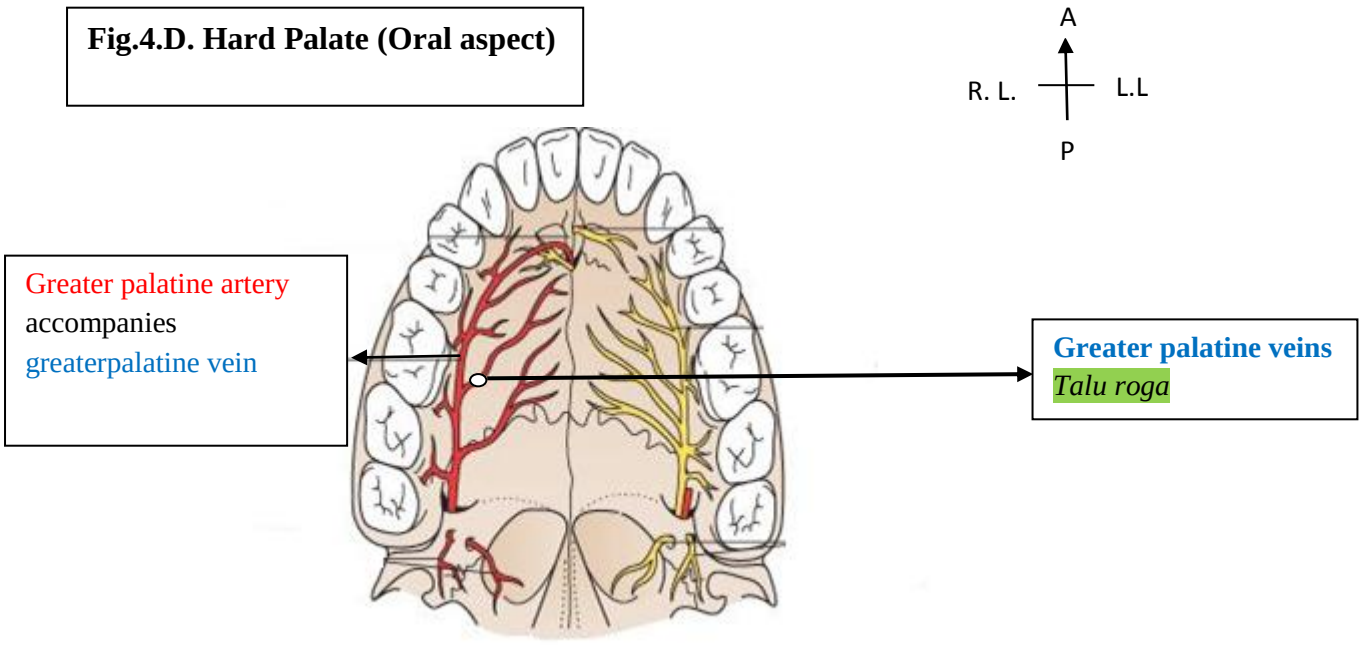
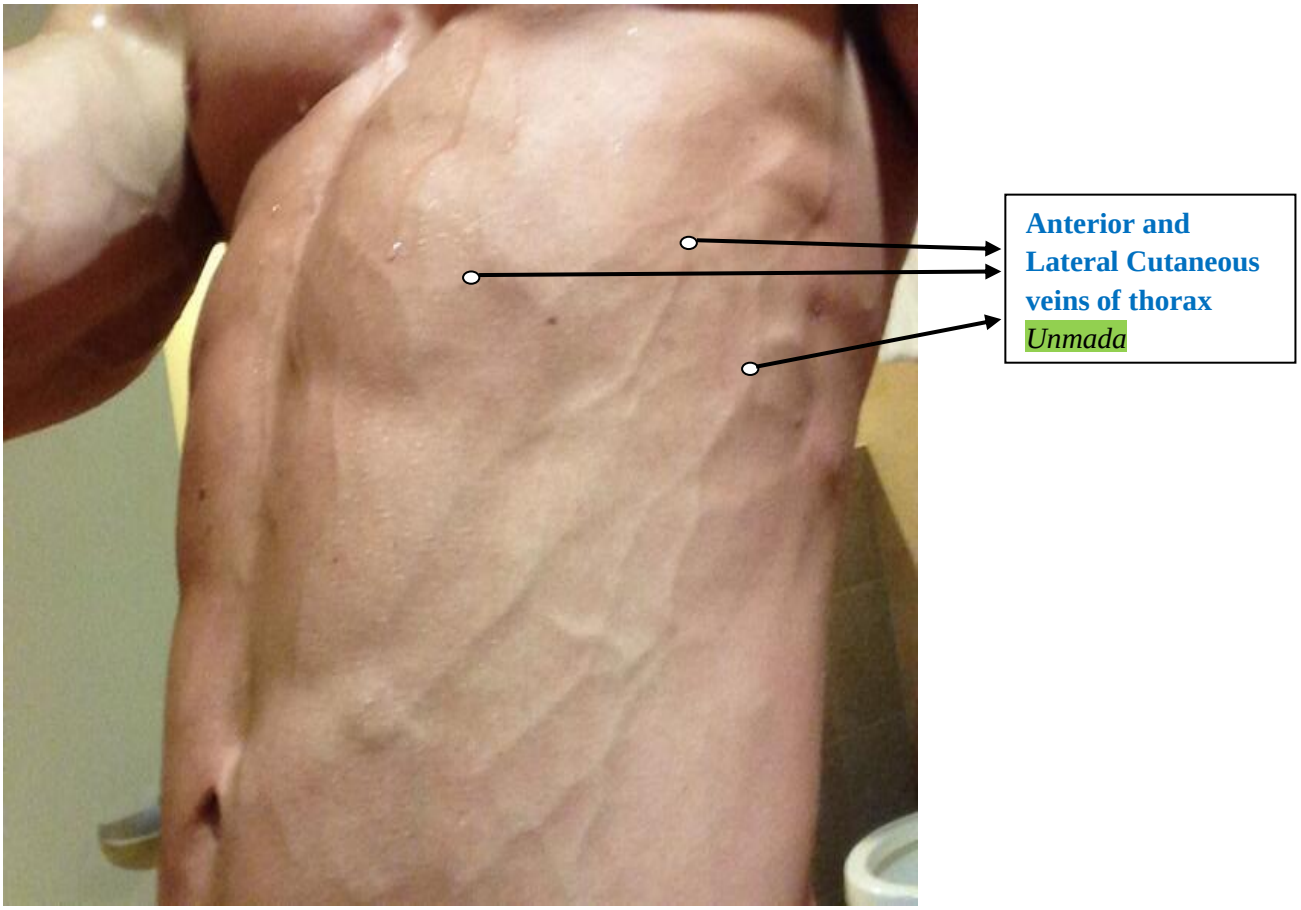


Fig.4.E. Tip of the Nose

Fig. 4. F. Left Lateral wall of Thorax



3. Theoretical interpretation of *Avedhya Sira*:

The *Avedhya Sira* are explained with following points.

i) Sutra in Devnagari

ii) Translation in English

iii) Considered site

iv) Structures at considered site

v) Interpretation

Shakha - Avedhya Sira*[36]: 1) *Adhoshakha

2) *Urdhwashakha*

i) *Sutra* in *devnagari*: तत्र सिराशतमेकस्मिन् सक्थ्नि भवति; **तासां जालधरा त्वेका, तिस्रश्चाभ्यन्तराः - तत्रोर्वीसंज्ञे द्वे, लोहिताक्षसंज्ञा चैका, तास्त्वव्यध्याः; एतेनेतरसक्थि बाहू च व्याख्यातौ; एवमशस्त्रकृत्याः षोडश शाखासु ।** **सु.शा.७/२२**

ii) Translation: One hundred *Sira* are present in one leg; of them, one *Jaladhara* and three internal ones-two *Urvi* and one *Lohitaksha*, should not be punctured.

1) *Adhoshakha- Avedhya Sira*[36]:

- ***Jaladhara*:** The word meaning of *Jala* is a net. The name *Jaldhara* is used because the *Sira* forms a network i.e. *Jala.* This sira is superficial (*Bahya)*

iv) Structures at considered site: The great saphenous vein is found in form of network with its tributaries *(Jaladhara),* and it is superficial[12] (*Bahya*)

When you puncture upper part bleeding occurs more than the lower part, terminal part of great saphenous vein carries more blood than the lower part. So it is harmful to puncture terminal part (just before the saphenous opening).

v) Interpretation: So upper part i.e. course of upper one third of great saphenous vein in the thigh (part before saphenous opening of great saphenous vein) can be considered as *Avedhya Sira* i.e. *Jaladhara Sira.* (See Fig. 5.A. On page 70)

Great saphenous[12]: This is the largest and longest vein of the lower limb. (Saphes = easily seen).

It begins on the dorsum of the foot from the medial end of the dorsal venous arch, and runs upwards in front of the medial side of the leg, and behind the knee. In the thigh it inclines forward to reach the saphenous opening where it pierces the cribriform fascia and opens into

the femoral vein. Before piercing the cribriform fascia, it receives three cutaneous veins, and also many unnamed tributaries.

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

The vein is also connected to the deep veins of the limb by perforating veins. There are three medial perforators just above 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 the deep veins. Failure of these valves also gives rise to varicose veins.

- ***Urvi Sira:***

Urvi is a *Sira Marma,* and injury to this *Marma* causes bleeding[37]. Such heavy blood loss may lead to death.

iii) Considered Site: The centre of the line joining the centre of the head of femur to the condyles of the femur[37].

iv) Structures at considered site: *Sushruta* told that *Urvi Sira* are 2 in number. If you see this site here we found two structures which are similar in function and structure and they are arteries which one is femoral artery[38] and another is profunda femories artery[39].

v) Interpretation: So here we can consider femoral artery and profunda femories arteries are two *Urvi Sira* which are *Avedhya Sira*. (See Fig. 5.B. On page 70)

Femoral artery[38]: This is the chief artery of lower limb. Developmentally it is not derived from axis artery. The original axis artery in the uppermost part of the limb is represented by the inferior gluteal artery.

Origin- it is continuation of external iliac artery. It begins behind the inguinal ligament at the mid inguinal point.

Extend and course – it passes downwards and medially, first in the femoral triangle, and then in the adductor canal, i.e. at the junction of the middle and lower thirds of the thigh it passes through an opening in the adductor magnus to become continuous with the popliteal artery.

Anterior relation of the femoral artery in the femoral artery in the femoral triangle; the main anterior relations are the skin, superficial fascia, deep fascia and the anterior wall of the femoral sheath.

Branches in the femoral triangle: the femoral artery gives off three superficial and three deep branches in the femoral triangle.

The superficial branches are: 1) Superficial external pudendal, 2) Superficial epigastric and 3) the superficial circumflex iliac.

The deep branches are: 1) Profunda femories, 2) Deep external pudendal and 3) Muscular branches.

The profonda femoris artery[39]: This is the largest branch of the femoral artery. It is the chief artery of supply to all three compartments of the thigh. It arises from the lateral side of the femoral about 4 cm below the inguinal ligament. The origin lies in front of the iliacus. As the artery descends, it passes posterior to the femoral vessels. It leaves the femoral triangle by passing deep to the adductor longus. Continuing downwards, it passes first between the adductor longus and the adductor brevis and then between the adductor longus and adductor magnus. Its terminal part pierces the adductor magnus to anastomose with upper muscular branches of the popliteal artery.

The profunda femoris artery gives off the medial and lateral circumflex femoral arteries, and four perforating arteries.

Clinical anatomy: 1. the femoral artery can be compressed at the midinguinal point against the head of the femur or against the superior ramus of the pubis to control bleeding from the distal part of the limb.

A) Pulsations of the femoral artery can be felt at the mid inguinal point, against the head of the femur and the tendon of the psoas major.

B) Stab wounds at the apex of the femoral triangle may cut large vessels of the lower limb because the femoral artery and vein and the profunda femoris artery and vein are arranged in one line from before backwards at this site.

C) Since the femoral artery is quite superficial in the femoral triangle, it can be easily exposed for ligation, i.e. tying, or for passing a canula or a thick needle.

- ***Lohitaksha Sira*:**

Lohitaksha is a *Sira Marma* and Injury to this *Marma* causes bleeding[37]. The blood loss may lead to death.

iii) Considered Site: Just below the *Vankshan Sandhi*[37] (just below the inguinal ligament).

iv) Structures at considered site: *Sushruta* told that *Lohitaksha Sira* is 1 in number in each *Shakha*. If you see this site (site of *Lohitaksha Marma*) here we found two structures one is femoral artery and another is femoral vein[40]. (femoral artery considered as *Urvi Sira*).

v) Interpretation: So here we can consider femoral vein is *Lohitaksha Sira*, which is *Avedhya Sira*. (See Fig. 5.A. On page 70)

Femoral vein[40]: It begins as an upwards continuation of the popliteal vein at the lower end of the adductor canal and ends by becoming continuous with the external iliac vein behind the inguinal ligament, medial to the femoral artery.

The vein is medial to the artery at the upper end, posterior to it in the middle, and lateral to it at the lower end.

Tributaries. It receives: 1) the great saphenous vein, 2) veins accompanying the three deep branches of the femoral artery in the femoral triangle, i.e. profunda, deep external pudendal, and muscular, 3) the lateral and medial circumflex femoral veins, and 4) the descending genicular and muscular veins in the adductor canal.

Clinical anatomy: The femoral vein is commonly used for intravenous infusions in infants and in patients with peripheral circulatory failure.

In lower extremities, we can consider terminal part of great saphenous vein as a Jaladhara Sira-(1+1), femoral artery-(1+1)and profunda femoris arteries-(1+1) as Urvi Sira and Femoral vein-(1+1) as Lohitaksha Sira.

Total = 8

Thus there are total 8 Avedhya Sira in lower extrimities.

Fig: 5. Adhoshakha - Avedhya Sira

Fig. 5. A. Ant. Aspect of Right Lower Extremity

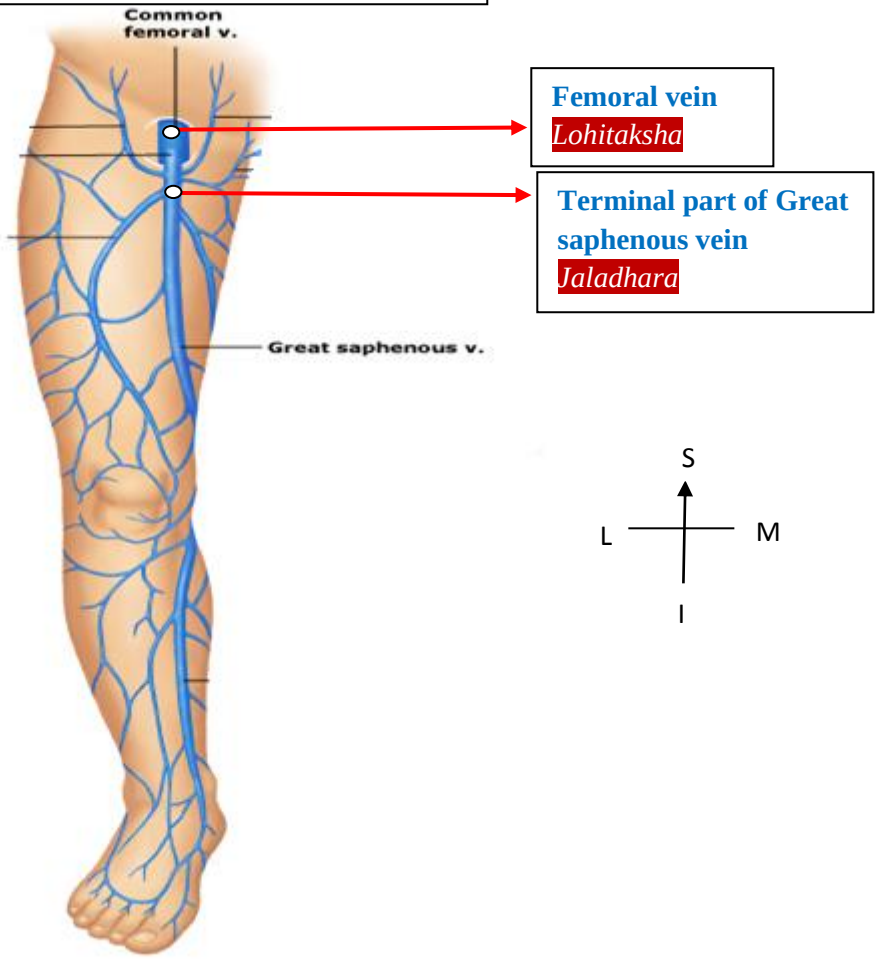
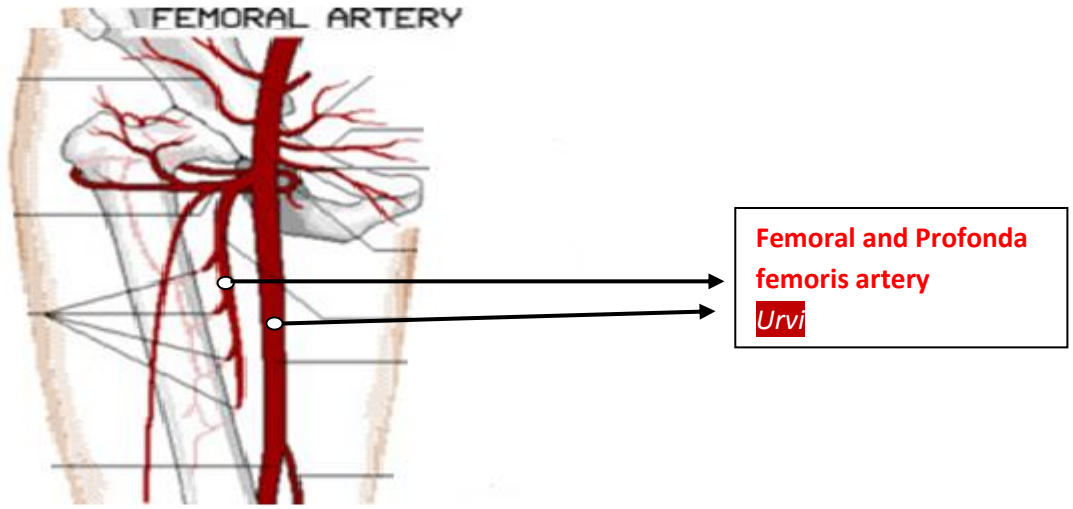


Fig.5. B. Ant. Aspect of Right Thigh



2. *Urdhwa Shakha - Avedhya Sira*[36]*:*

- ***Jaladhara:*** The word meaning of *Jala* is a net. The name *Jaladhara* is used because the *Sira* forms a network i.e. *Jaal.* This *Sira* is superficial (*Bahya*)

iv) Structures at considered site: The cephalic vein is found in form of network with its tributaries[18].

When you puncture upper part bleeding occurs more than the lower part, terminal part of cephalic vein carries more blood than the lower part. So it is harmful to puncture terminal part (just before the deltopectoral groove).

v) Interpretation: So upper part i.e. course of upper one third of cephalic vein in the arm (before joining of axillary vein) can be consider as *Avedhya Sira* i.e. *Jaladhara Sira*. (See Fig. 6.A. On page 74)

Cephalic vein[18]: it is preaxial vein of the upper limb (cf. great saphenous vein of the lower limb).

It begins from the lateral end of the dorsal venous arch.

It runs upwards through the roof of the anatomical snuff box, winds round the lateral border of the distal part of the forearm, continues upwards in front of the elbow along the lateral border of the biceps brachii, pierces the deep fascia at the lower border of the pectoralis major, runs in the deltopectoral groove up to the infraclavicular fossa, where it pierces the clavipectoral fascia and joins the axillary vein.

At the elbow greater part of the blood is drained into the basilic vein through the median cubital vein and partly also into the deep veins through the perforator vein.

- ***Urvi (Bahavi) Sira*:**

Urvi (Bahavi) is a *Sira Marma* and injury to this *Marma* causes bleeding[37]. The blood loss may lead to death.

iii) Considered Site: The centre of the line joining the centre of the head of humerus to the condyles of the humerus[37].

iv) Structures at considered site: *Sushruta* told that *Urvi (Bahavi) Sira* are 2 in numbers. If you see this site here we found two structures which are similar in function and structure and they are arteries which one is brachial artery[41] and another is profunda brachi artery[41].

v) Interpretation: So here we can consider brachial artery and profunda brachi arteries are two *Urvi Sira* which are *Avedhya Sira*. (See Fig. 6.B. On page 74).

Brachial artery[41]: It is the continuation of the axillary artery, from the medial side of the arm to the front of the elbow. It is superficial throughout its extend and is accompanied by two venae comitantes.

Branches: 1. Unnamed muscular branches 2. The profunda brachii artery 3. The superior ulnar collateral branch 4. A nutrient artery 5. The inferior ulnar collateral 6. The artery ends by dividing into two terminal branches, the radial and ulnar arteries.

Applied anatomy: 1. Brachial pulsations are felt or ausculated in front of the elbow just medial to the tendon of biceps while recording the blood pressure. 2. Although the artery can be compressed along it course it can be compressed most favourably in the middle of the arm, where the artery lies on the tendon of the coracobrachialis.

The profunda brachii artery[41]: It is large branch of the brachial artery, arising just below the teres major. It accompanies the radial nerve through radial groove and before piercing the lateral intermuscular septum it divides into the anterior and posterior descending branches which take part in the anastomosis around the elbow joint.

- ***Lohitaksha Sira:***

Lohitaksha is a *Sira Marma* and injury to this *Marma* causes bleeding[37]. The blood loss may lead to death.

iii) Considered Site: Just below the *Kaksha Sandhi*[37](just below the shoulder joint)

iv) Structures at considered site: *Sushruta* told that *Lohitaksha Sira* is 1 in number in each *Shakha*. If you see this site (site of *Lohitaksha Marma)* here we found axillary artery and axillary vein. (In lower extremities we considered femoral vein as *Avedhya Sira* so here we considered axillary vein[42] as *Avedhya Sira*, and even in *Sushruta Samhita* also *Sushruta* told that same structures should consider in upper extremities.)

v) Interpretation: So here we can consider axillary vein is *Lohitaksha Sira* which is *Avedhya Sira*. (See Fig. 6.A. On page 74)

Axillary vein[42]: The axillary vein is the continuation of the basilic vein. The axillary vein joined by the vena comitants of the brachial artery a little above the lower border of the teres major muscle. It lies on the medial side of the axillary artery. At the outer border of the first rib it becomes the subclavian vein. In addition to the tributaries corresponding to the branches of the axillary artery, it receives the cephalic vein in its upper part.

In upper extremities, we can consider terminal part of cephalic vein- (1+1)as a Jaladhara Sira, brachial artery - (1+1)and profunda brachii arteries- (1=+1) as Urvi Sira and axillary vein- (1+1) as Lohitaksha Sira.

Total = 8

Thus there are total 8 Avedhya Sira in upper extremities.

Fig. 6. *Urdhwashakha - Avedhya Sira*

Fig. 6. A. Veins of Right Upper Extremity

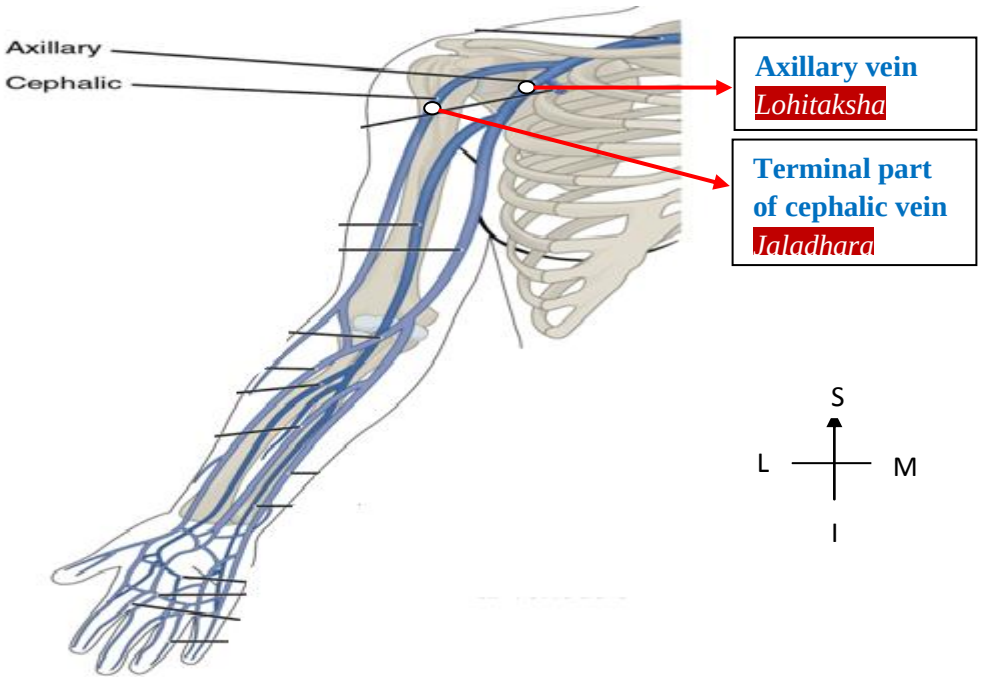
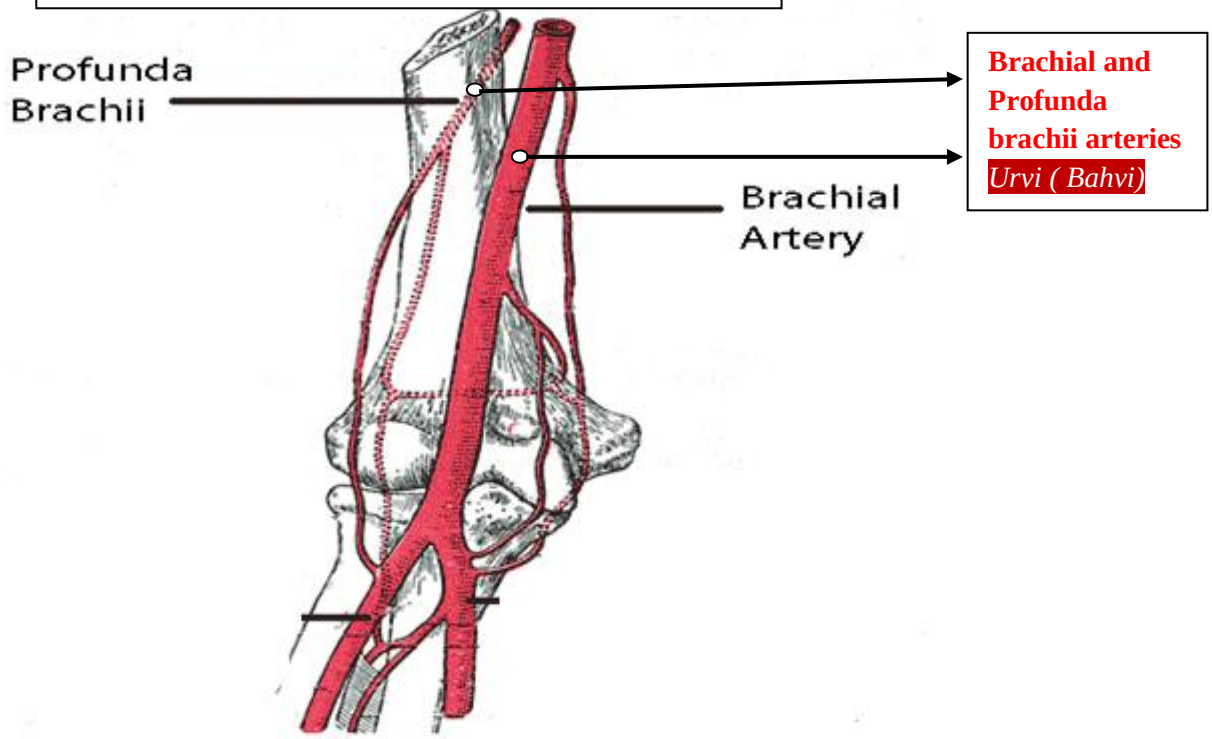


Fig. 6. B. Right Upper Extremity (Brachial artery)



2. *Madhya Sharir - Avedhya Sira*[36]:

- ***Shroni*:**

i) *Sutra* in *devnagari:* द्वात्रिंशच्छ्रोण्यां, तासामष्टावशस्त्रकृत्याः - **द्वे द्वे विटपयोः, कटीकतरुणयोश्च**

सु.शा.७/२२

ii) Translation: Thirty two are in *Shroni Pradesh,* of them, eight should be avoided for *Siravedha*. At the *Vitap* two in each side and similarly *Katiktarun* (two in each side)

iii) Considered Site: 0 **Vitap:** Site of *Vitap Marma* is in between *Vankshan* and *Vrushan*[37]. When we correlate this with modern the location of this *Marma* is 1 inch lateral to the pubic symphasis. (In front of spermatic cord)

iv) Structures at considered site: Vitapgat: The superficial external pudendal artery pierces the cribiform fascia, runs medially in front of the spermatic cord, and supplies the external genitalia[43].

The superficial epigastric artery pierces the cribriform fascia, runs towards the umbilicus, and supplies the lower part of the abdominal wall[43].

When we see the course of superficial external pudendal artery and superficial epigastric artery they run in location of *Vitap Marma*.

v) Interpretation: So we can consider superficial external pudendal artery and the superficial epigastric artery as *Avedhya Sira*. (See Fig. 7.A. On page 81)

- ***K*atiktarun:** It is an *Asthi Marma.* The location of these *Marma* is in the region of *Shronikand* on the both sides of *Prushthavansha (Sacro-iliac articulation or sciatic notch).*[44] Injuries to this *Marma* causes bleeding resulting in anaemia. Due to blood loss death may occure[45].

iii) Considered Site: Sciatic notch and medial half of gluteal region (Lateral to the sacrum).

iv) Structures at considered site: The blood supply of the skin and subcutaneous tissue of the gluteal region is derived from perforating branches of the superior and inferior gluteal vessels[46]. (These two arteries come in gluteal region from greater sciatic notch.)

v) Interpretation: So we can consider superior gluteal artery and inferior gluteal artery as *Avedhya Sira*.(See Fig. 7.B. On page 81)

Vitap = superficial external pudendal artery - 1 + 1 = 2, the superficial epigastric artery- 1 + 1 = 2, 2+2=4

Katiktarun= superior gluteal artery-1+1= 2+ inferior gluteal artery -1+1= 2, 2+2=4

Total=4+4=8

Thus there are total 8 Avedhya Sira in Shroni Pradesh.

- ***Parshwa:***

i) *Sutra* in *devnagari*: अष्टावष्टावेकैकस्मिन् पार्श्वे, **तासामेकैकामूर्ध्वगां परिहरेत्, पार्श्वसन्धिगते च द्वे;** ।

सु.शा.७/२२

ii) Translation: Eight are in each *Parshwa*, out of them one going upwards on each side and two in *Parshwasandhi* should be avoided.

- ***Urdhwag:***

iii) Considered Site: *Parshwa*: Lateral wall of thorax and abdomen: ref;- बाहुभ्यामवलम्बमानदेहस्य पार्श्वयोः । **सु.शा.८ /८**(In *Parshwa*, *Siravedha* should be done while arms are hanging down.) From this reference we can understand that, *Parswa* means the portion of body which comes in contact with upper limb[47] (Lat. wall of thorax and abdomen).

iv) Structures at considered site: Subscapular artery: This is the largest branch of the axillary artery, arising from its third part. It runs along the lower border of the subscapularis. Its major branches, the circumflex scapular and thoracodorsal arteries. The latter runs (Thoracodorsal arteries) to the chest wall parallel to the margin of latissimus dorsi together with the thoracodorsal nerve to that muscle. The thoracodaorsal artery coincides with above site [48](*Parshwa*)

v) Interpretation: So we can consider Thoracodorsal artery as *Avedhya Sira* of *Parshwa* (*Urdhwag*). (See Fig. 7.E. On page 84)

- ***Parshwa Sandhigat:***

ii) Considered Site: *Parshwa Sandhi* is a *Sira Marma*, and location of this *Marma* is Superolateral to lumber region (just above the lumber triangle)[45]

iii) Structures at considered site: When we see this particular site, there is no any specific artery; here we can see only cutaneous arteries which supply the skin and subcutaneous tissue of this region.

v) Interpretation: So here we considered any two non specific cutaneous arteries.

Urdhwag = Thoraco dorsal artery -1+1= 2,

Parshwa Sandhigat = Non specific Cutaneous arteries-1+1=2

Total 2+2=4

Thus there are total 4 Avedhya Sira in upper Parshwa.

- ***Prushtagat*:**

i) *Sutra* in *devnagari:* चतस्रो विंशतिश्च पृष्ठे पृष्ठवंशमुभयतः, **तासामूर्ध्वगामिन्यौ द्वे द्वे परिहरेद्बृहतीसिरे;** ।

सु.शा.७/२२

ii) Translation: Twenty four *Sira* are present in back region on both side of the *Prushtvansha* (vertebral column), of them two *Bruhati Sira* going upwards on each side should be avoided.

iii) Considered Site: Site of *Bruhati Marma* is on the back side on each side of the vertebral column. Exactly opposite to the *Stanamula Marma*[45](at inferior angle of the scapula)

iv) Structures at considered site: The circumflex scapular artery anastomosis with deep branch of the transverse cervical artery at the inferior angle of the scapul*a*[49.]

Subscapular artery is the largest branch of the axillary artery, arising from its third part. It runs along the lower border of the subscapularis to terminate near the inferior angle of the scapula. It supplies the lattisimus dorsi, and the serratus anterior. It gives off a large branch, the circumflex scapular artery. This branch passes through the triangular intermuscular space, winds round the lower border of the scapula deep to the teres minor and gives a branch to the subscapular fossa (infrascapular branch), and another branch to the infraspinous fossa., both of which take part in the anastomosis around the scapula.

Deep branch of transverses cervical artery is a branch of the thyrocervical trunk (subclavian artery), it runs along the medial border of scapula and ends at inferior angle of scapula. (And anastomosis with circumflex scapular artery at inferior angle of scapula)

v) Interpretation: So we can consider anastomosis area is a single *Sira* i.e. *Bruhati Sira a*nd this *Sira* should be avoided. (See Fig. 7.C. On page 82)

Prushtagat = Area of Anastomosis at inferior angle of scapula- R.t1 + Lt. 1 = 2

Thus there are total 2 Avedhya Sira in Prushtha.

- ***Udar:***

i) *Sutra* in *devnagari*: तावत्य एवोदरे, तासां **मेढ्रोपरि रोमराजीमुभयतो द्वे द्वे परिहरेत्;** । **सु.शा.७/२२**

ii) Translation: There are twenty four *Sira* in abdomen; of them, two on both sides of the hair line *(Romraji Ubhayata)* above penis *(Medhropari)* should be avoided**.**

iii) Considered Site: On each side of the linea alba (hair line) or midline of the abdomen just above penis.

iv) Structures at considered site: The inferior epigastric artery and the inferior epigastric vein runs on both sides of the hair line above the penis[50].

The inferior epigastric artery arises from the external iliac artery near its lower end (just below the inguinal ligament). It runs upwards and medially in the extra- peritoneal connective tissue, passes just medial to the deep inguinal ring, pierces the fascia transversalis at the lateral border of the rectus abdomines and enters the rectus sheath by passing in front of the arcuate line. Within the sheath it supplies the rectus muscle and ends by anastomosing with the superior epigastric artery.[50]

The inferior epigastric vein runs along with the inferior epigastric artery and drains into external iliac vein.

v) Interpretation: So we can consider the inferior epigastric artery and the inferior epigastric vein as *Avedhya Sira*. (See Fig. 7.D. On page 83)

Udar (Medhropari Romraji Ubhayata) =Inferior epigastric artery - 2+ inferior epigastric vein - 2= 4

Thus there are total 4 Avedhya Sira at Udar.

- ***Vaksha:***

i) *Sutra* in *devnagari:* चत्वारिंशद्वक्षसि, तासां चतुर्दशाशस्त्रकृत्याः - **हृदये द्वे, द्वे द्वे स्तनमूले, स्तनरोहितापलापस्तम्भेषूभयतोऽष्टौ, एवं द्वात्रिंशदशस्त्रकृत्याः पृष्ठोदरोरःसु भवन्ति । सु.शा.७/२२**

ii) Translation: Forty *Sira* are in thorax, of them fourteen are avoidable- two at *Hrudya, Stanmula* two each, eight *Sira* on the either side of *Stanrohita, Apalap* and *Apastambha.* Thus fourteen *Avedhya Sira* are present in *Vaksha* region.

Thus thirty two Sira in back, abdomen and thorax are *Avedhya Sira*.

iii) Considered Site: Here sites of following *Uragat Marma*[51] are considered as sites of *Avedhya Sira.*

- ***Hrudya***: It lies in between *Stan*.
  Stanmula: Two *Angula* below the *stan (nipple).*
  Stanrohit: Two *Angula* above *nipple.*
  Apastambh: Near sternal angle.
  Apalap: Anterior axillary fold (at the level of second rib).

iv) Structures at considered site: Here we considered arteries present at *Urgat Marma.*

***Hrudaya*: Internal thoracic artery runs** in this region. Internal thoracic artery arises from the inferior aspect of the first part of the subclavian artery opposite the thyrocervical trunk. Below the first costal cartilage the artery runs vertically downwards up to its termination in the sixth intercostal space. The artery terminates in the sixth intercostal space by dividing into the superior epigastric and musculophrenic arteries[52].

***Stanmula*:**

The musculo phrenic artery and the superior epigstric artery[52.]

The musculophrenic artery is continuation of internal thoracic artery, run downwards and laterally behind the 7th, 8thand 9th costal cartilages.

The superior epigastric artery runs behind the 7th costal cartilage and enters the rectus sheath by passing between the sternal and costal slips of the diaphragm.

Stanrohit, Apalap, Apastambh : (eight *Avedhya Sira* on the sides of *Stanrohita*, *Apalap* and *Apastambha)*

Superior thoracic artery, arises from the first part of the axillary artery. It runs downwards, forwards and medially, passes between the two pectoral muscles and ends by supplying these muscles the thoracic wall[53].

The thoraco-acromial artery. This is a branch from the second part of the axillary artery. It emerges at the upper border of the pectoralis minor, pierces the clavipectoral fascia, and soon divides into four terminal branches. The pectoral branch passes between the pectoral muscles supplies these muscles as well as the breast. The acromial branch crosses the coracoids process ends by joining the anastomosis over the acromion. The clavicular branch runs superomedialy deep to the pectoralis major, supplies the sternoclavicular joint and the subclavis[53]. (This artery is devided into two parts one is thoraco and another is acromial part. So here we counted as 2 *Avedhya Sira*.)

Lateral thoracic artery: This is a branch of the second part of the axillary artery. It emerges at and runs along, the lower border of the pectoralis minor in close relation with the anterior group of axillary lymph nodes. In females, the artery is large and gives off the lateral mammary branches to the breast[53].

v) Interpretation: So here we can consider internal thoracic artery, musculophrenic artery , superior epigastric artery. superior thoracic, thoraco acromial (Thoraco part and acromial part), and lateral thoracic artery as *Avedhya Sira*.(See Fig. 7.F. On page 84 and fig. 7.G. On page 85)

Hrudaya = Internal thoracic artery- 1+1=2.

Stanmula = Musculophrenic artery-2 + superior epigastric artery -2=4.

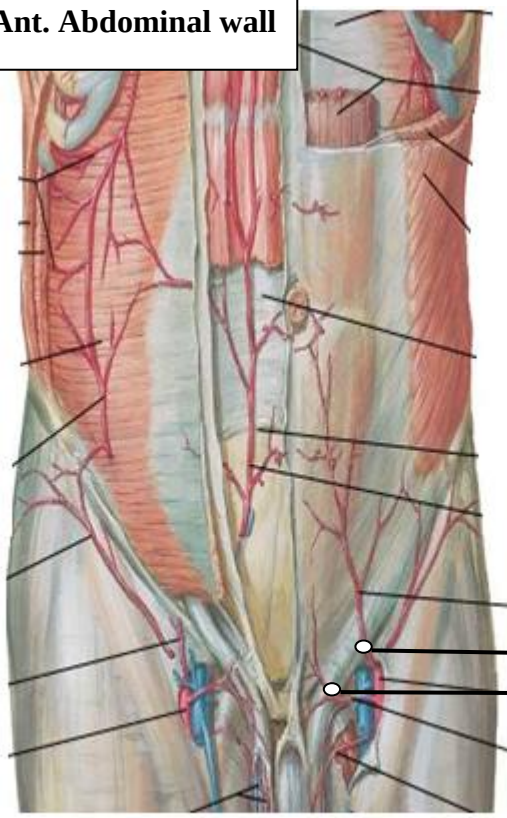
On the sides of *Stanrohita, Apalap* and *Apastambha = Superior thoracic- 2. Thoraco acromial (Thoraco part 2 and acromial part 2) -4, Lateral thoracic artery-2. Total=8.*

Total = 2+4+8=14

Thus there are total 14 Avedhya Sira in Vaksha Pradesh.

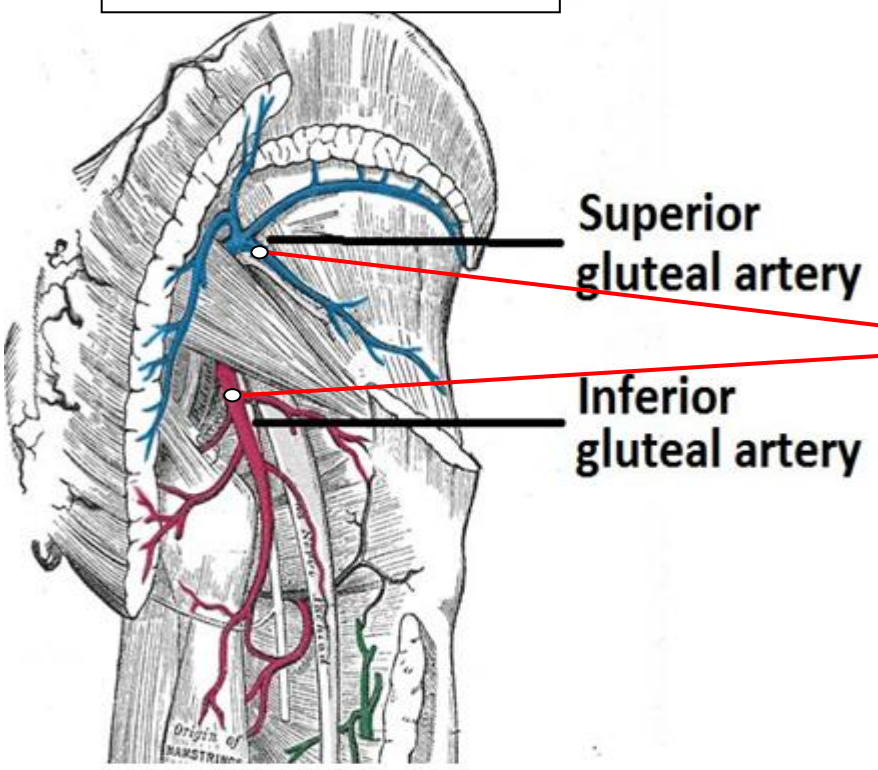
Fig. 7. *Madhya Sharir - Avedhya Sira*

Fig. 7. A. Ant. Abdominal wall



Superficial epigastic artery & superficial pudendal artery
Vitapgat

Fig. 7. B. Right Gluteal region



Shroni:
Katiktarun

Fig. 7.C. Anastomosis around the inferior angle of Right scapula

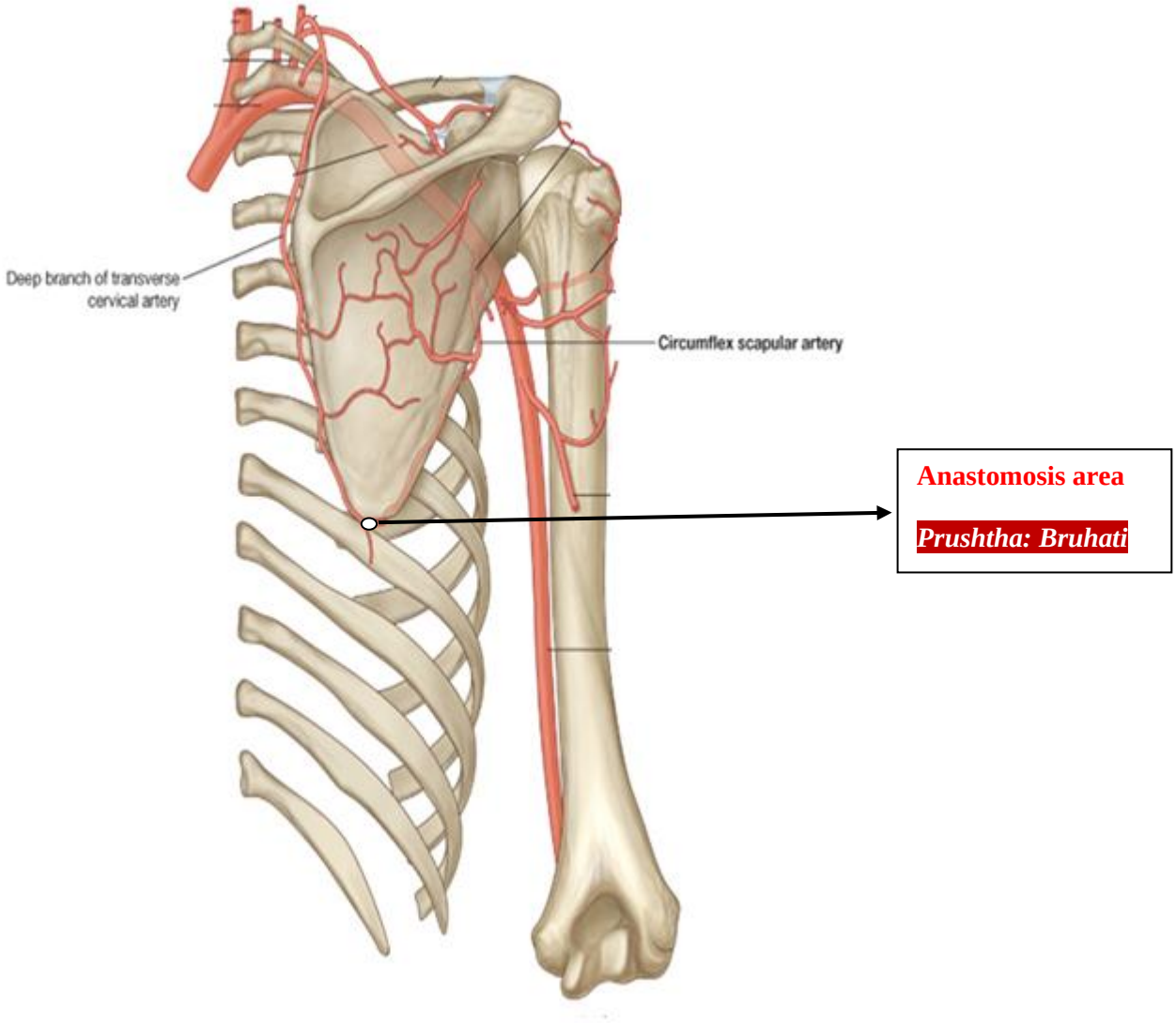


Fig. 7. D. Anterior aspect of Ant. Abdominal wall

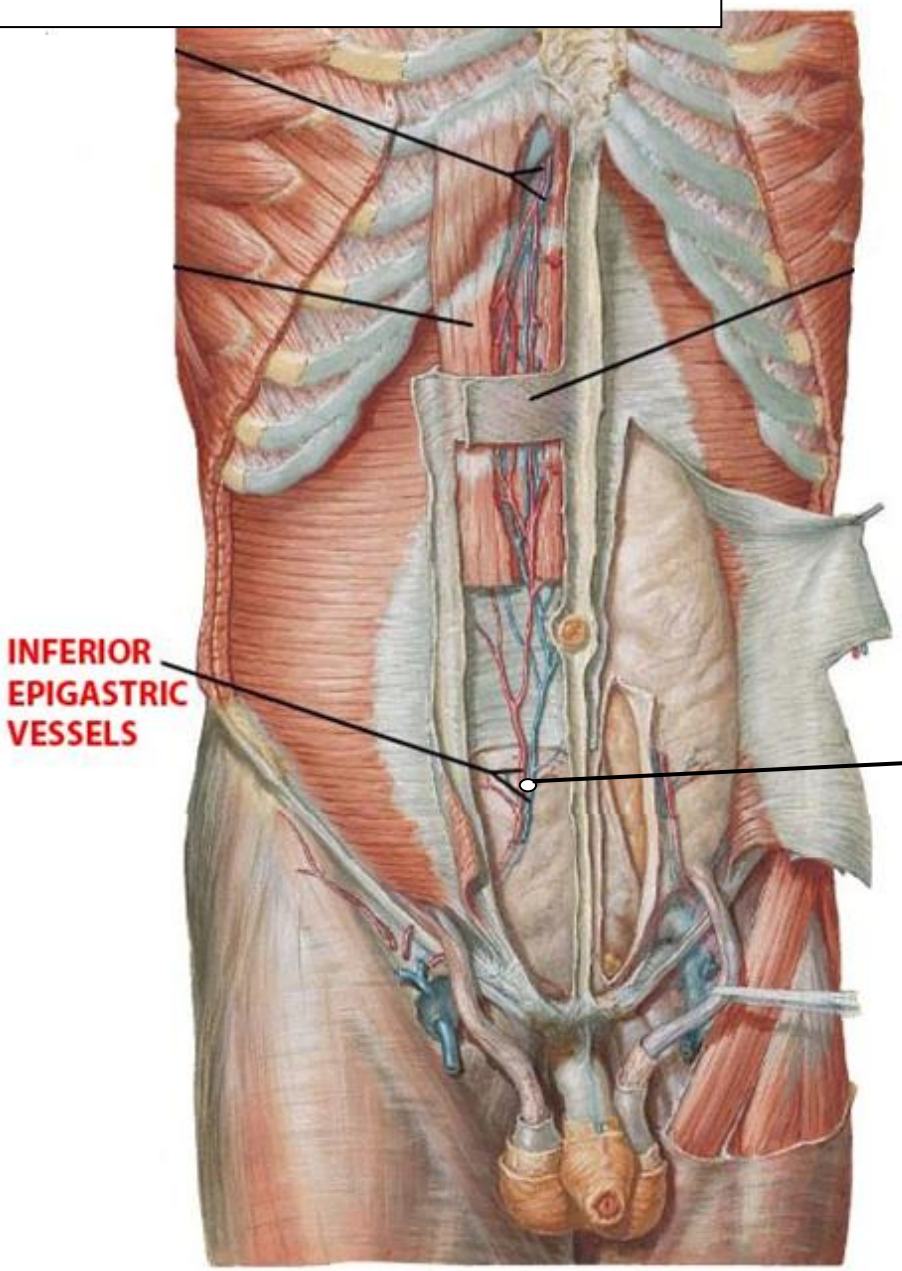


Fig. 7. E. Right. Axillary artery and its branches

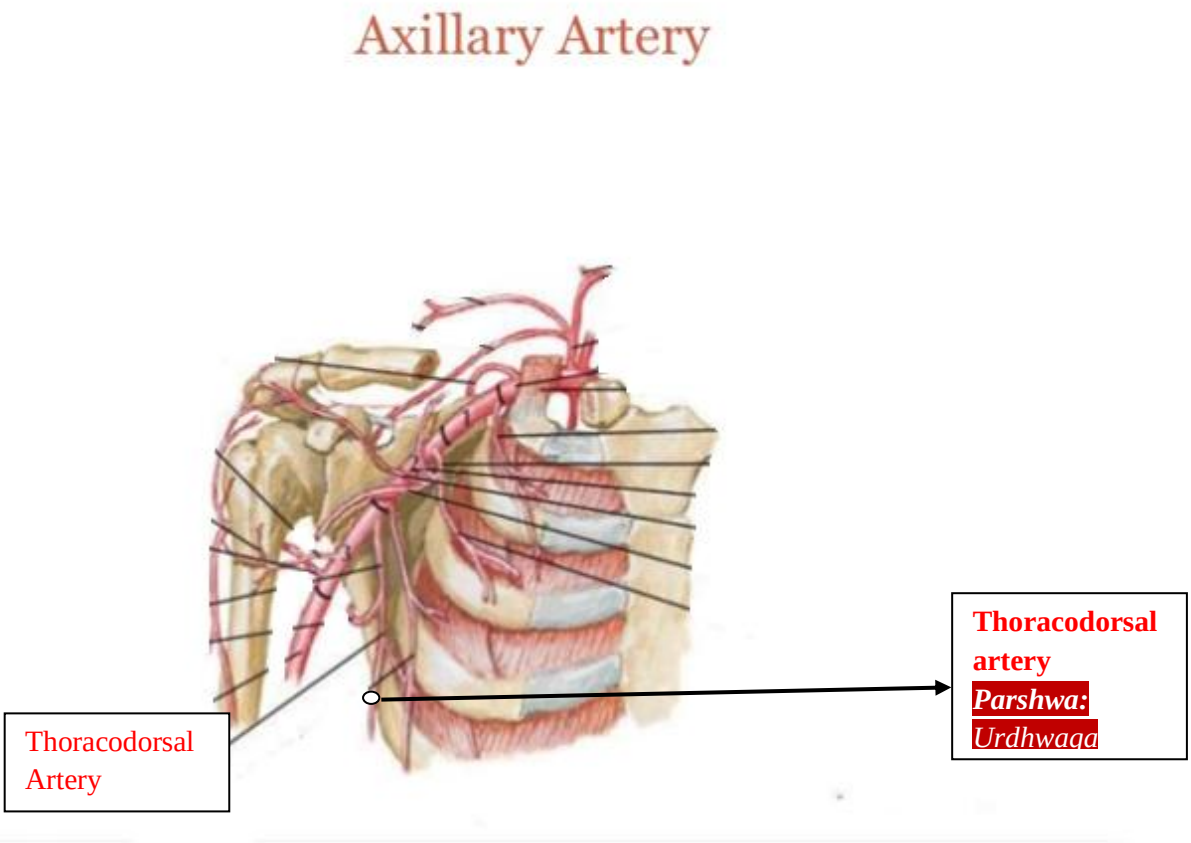


Fig. 7. F. Right Axillary artery and its branches

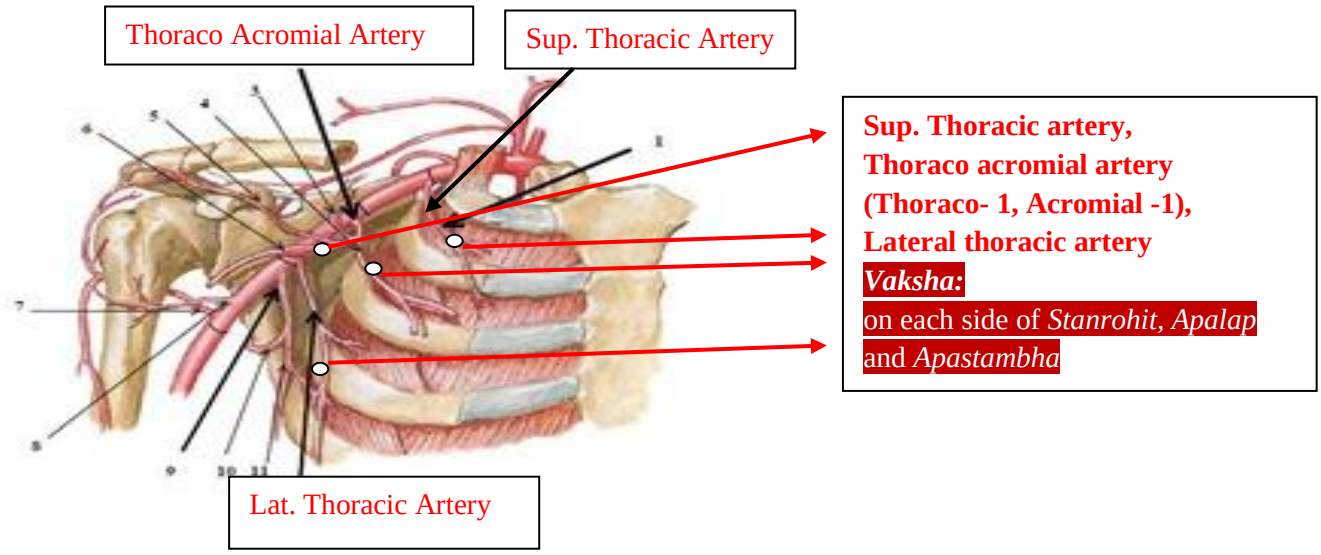
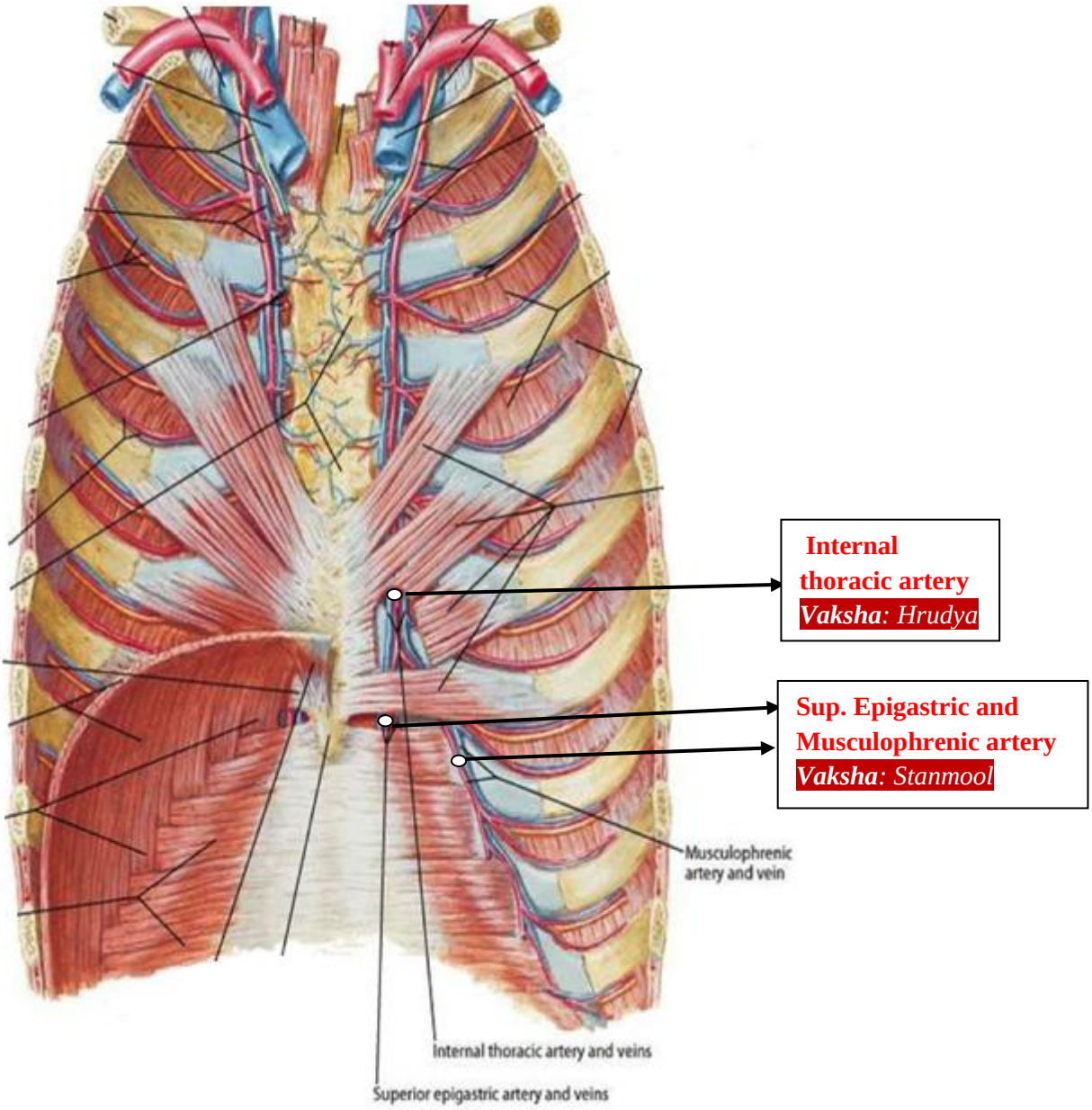


Fig. 7. G. Posterior aspect of anterior thoracic wall



3. Urdhwa Jatru - Avedhya Sira[36];

- ***Griva:***

i) *Sutra* in devnagari: चतुःषष्टं सिराशतं जत्रुण ऊर्ध्वं भवति, तत्र षट्पञ्चाशच्छिरोधरायां**, तासामष्टौ चतस्रश्च मर्मसंज्ञाः परिहरेत्, द्वे कृकाटिकयोः, द्वे विधुरयोः, एवं ग्रीवायां षोडशाव्यध्या[3]: । सु.शा.७/२२**

ii) Translation: fifty six *Sira* are in neck, out of them twelve *Marma* (Eight- *Matruka* and four – two *Nila* and two *Manya*), apart from two each in *Krukatika* and *Vidhura*. - thus sixteen *Sira* in neck should not be punctured *(Avedhya Sira).*

iii) Considered Site:

- ***Twelve Marma**:* (Eight- *Matruka* and four – two *Nila* and two *Manya*)[54] These twelve *Marma* are present in front side of the neck. (All are *Sira Marma).*The Injury to this *Marma* causes bleeding which leads to deformity or death.
- ***Krukatika*[53]:** Atalanto-occipital joint.
- ***Vidhur*[53]:** Just behind and below the ear.

iv) Structures at considered site:

Twelve Sira: Common carotid artery: External carotid artery: Internal carotid Artery[55], External jugular vein, internal jugular vein, Anterior jugular vein: [56] (Considered both sides from mid line of the neck) these twelve vessels present at the site of these *Marma*. (6+6=12 vessels)

***Krukatika*:** Occipital artery runs in this region[57]. (1+1 =2 arteries)

***Vidhur*:** Posterior auricular artery crosses the base of the mastoid process and ascends behind the auricle[57]. (1+1 =2 arteries)

v) Interpretation: So we can consider above 16 vessels as *Grivagat Avedhya Sira*. (See Fig. 8.A. On page 96)

External jugular vein: lies deep to the platysma. It is formed by union of the posterior auricular vein with the posterior division of retromandibular vein. It begins within the lower part of the parotid gland, crosses the sternomastoid obliquely, pierces the anterioinferior triangle, and opens into the subclavian vein. *Its tributaries are; a) the posterior external jugular vein, b) the transverse cervical vein; c) suprascapular vein and the anterior jugular vein. The oblique jugular vein connects the external jugular vein with the internal jugular vein across the middle one-third of the anterior border of the sternomastoid.*

The external jugular vein is examined to assess the venous pressure, the right atrial pressure is reflected in it because there are no valves in the entire course of this vein.

Internal jugular vein: It is direct continuation of the sigmoid sinus. It begins at the jugular foramen and ends behind the sternal end of the clavical by joining the subclavin vein to form the brachiocephalic vein.

Relations: Superficially: sternomastoid, posterior belly of omohyoid, paratoid gland, styloid process, accessory nerve, posterior auricular artery, occipital artery, steromastoid arteries, lower root of ansa cervicalis, infrahyoid muscles, anterior jugular vein, deep cervical lymph nodes and the internal ceratoid artery.

Tributaries: 1. Inferior petrosal sinus, 2. Common facial vein, 3. Lingual vein, 4. Pharyngeal veins, 5. Superior thyroid vein, 6. Middle thyroid vein and 7. Some times the occipital vein.

Applied anatomy: A. Deep to the lesser supraclavicular fossa, the internal jugular vein is easily accessible for recording of venous pulse tracing.

B. In congestive cardiac failure or any disease where venous pressure is raised, the internal jugular vein is markedly dilated engorged.

Anterior jugular vein: Beginning in the submental region below the chin. It descends in the superficial fascia 1cm from the median plane. About 2.5 cm above the sternum, it pierces the investing layer of deep fascia to enter the suprasternal space where it is connected to its fellow of the opposite side by transverse channel, the jugular venous arch. The vein then turns laterally, runs deep to the sternocleidomastoid just above the clavicle and ends in the external jugular vein at the posterior border of the sternocleidomastoid.

Common carotid artery: The right common carotid artery is a branch of the brachiocephalic artery. It begins in the behind the right sternoclavicular joint. The left common carotid is a branch of arch of aorta. It begins in the thorax in front of the trachea opposite a point a little to the left of the centre of the manubrium. It ascends to the back of the sternoclavicular joint and enters the neck.

In the neck, both arteries have a similar course. Each artery runs upwards within the carotid sheath, under cover of the anterior border of the sternomastoid. It lies in front of the lower four cervical transverse processes. At the level of the upper border of the thyroid cartilage the artery ends by dividing into external and internal carotid arteries.

External carotid artery: It is one of the terminal branches of the common carotid artery. In general it lies anterior to the internal carotid artery and is the chief artery of supply to structures in the neck in the front of the neck and in the face.

Course and relations: The external carotid artery begins in the carotid triangle at the level of the upper border of the thyroid cartilage. It runs upwards and slightly backwards and laterally

and terminates behind the neck of the mandible by dividing into the maxillary and superficial temporal arteries.

In the carotid triangle, the external carotid artery is comparatively superficial and lies under cover of the anterior border of the sternomastoid.

Above the carotid triangle the external carotid artery lies deep in the substance of the paratoid gland.

Branches: The external carotid gives off eight branches which may be grouped as follows.

A. *Anterior: 1. superior thyroid, 2. Lingual and 3. Facial.*
B. *Posterior: 1. Occipital, 2. Posterior auricular.*
C. *Medial: Ascending pharyngeal*
D. *Terminal: 1. Maxillary, and 2. Superficial temporal.102*

Internal carotid Artery: The internal carotid artery is one of the terminal branches of the common carotid artery. It begins at the level of the upper border of the thyroid cartilage opposite the disc between the third and fourth cervical vertebra, and ends inside the cranial cavity by supplying the brain. This is the principal artery of brain and the eye. It also supplies the related bones and meninges. Its course is divided into following four parts. A. Cervical part. B. Petrous part C. Cavernous part D. Cerebral part.

Cerebral part: This part lies at the base of the brain after emerging from the cavernous sinus. It gives off the following arteries: a) ophthalmic b) anterior cerebral, c) middle cerebral, d) posterior communicating, and e) anterior chorodial. Of these, the ophthalmic artery supplies in the orbit, while the other supply the brain.

***Krukatika*:** Occipital artery runs in this region.

Occipital artery *(Krukatika)*: It arises from the external carotid artery, opposite the origin of the facial artery. It runs posterosuperiorly deep to the posterior belly of digastrics.

It then passes posteriorly immediately deep to the muscles attached to the superior nuchal line, crosses the apex of the posterior triangle and pierces trapezius 2.3 cm from the midline with the greater occipital nerve. It ramifies on the back of the head, supplying the posterior half of the scalp.

Its branches in this region are: 1.Mastoid, 2. Meningeal, and 3. Muscular. One of the muscular branches is large called as descending branch. It has superficial and deep branches. The superficial branch anastomoses with the superficial branch of the transverse cervical artery; while the deep branch descends between the semispinalis capitis and cervicis, and anastomosis with the vertebral and deep cervical arteries.

***Vidhur*:** Posterior auricular artery crosses the base of the mastoid process, and ascends behind the auricle.

Posterior auricular artery (*Vidhur*): The posterior auricular artery arises from the posterior aspect of the of the external carotiod just above the posterior belly of the diagstric. It runs upwards and backwards deep to the paratoid gland, but superficial to the styloid process. It crosses the base of the mastoid process, and ascends behind the auricle. It supplies the back of the auricle, the skin over the mastoid process and over the back of the scalp. Its stylomastoid branch enters the stylomastoid foramen and supplies the middle ear, the mastoid antrum and air cells, the semicircular canals and the facial nerve.

v) Interpretation: So in neck region these vessels can be considered as *Avedhya Sira.*

Twelve Marma = External jugular vein -2 + internal jugular vein -2 + anterior jugular vein -2 + common carotid artery- 2 + external carotid artery-2 + internal carotid artery- 2 =12

Krukatika = Occipital artery- 2

Vidhur = posterior auricular artery -2

Total = 12 + 2 + 2 = 16

Thus there are total 16 Avedhya Sira presents in Griva.

- ***Hanu:***

i) *Sutra* in *devnagari*: हन्वोरुभयतोऽष्टावष्टौ, **तासां तु सन्धिधमन्यौ द्वे द्वे परिहरेत् । सु.शा.७/२२**

ii) Translation: Eigth *Sira,* are present on each side of jaw of which, *Sandhidhamanis* two on each side are *Avedhya Sira*.

iii) Considered Site: हन्वोरित्यादि सन्धिधमन्यौ इति हनुसन्धिधमन्यावित्यर्थः **सु.शा.७/२२ (डल्हण टीका)**

Dalhana- Hanu Sandhidhamani means *Sira* of *Hanu Sandhi*[58](*Hanu sandhi* - Temporomandibular joint).

iv) Structures at considered site: Transverse facial artery: is a branch of the superficial temporal artery. After emerging from the paratoid gland, it runs forwards over the masseter between the paratoid duct and the zygomatic arch, accompanied by the upper buccal branch of the facial nerve. It supplies the paratoid gland and its duct, masseter and the overlying skin, and ends by anastomosing with neighbouring arteries[59]. (This artery is nearer to the temporomadibular joint)

Branch of superficial temporal artery: Temporomandibular joint is supplied by branches from superficial temporal and maxillary arteries[60].

v) Interpretation: So we can consider transverse facial artery and branch of superficial temporal artery as *Avedhya Sira*. (See Fig. 8.D. On page 99)

***Hanusandhidhamani =Transverse facial artery- 2* + Branch of superficial temporal artery -2**

Total = 4

Thus there are total 4 Avedhya Sira at Hanu.

- ***Jivha:***

i) *Sutra* in *devnagari*: षट्त्रिंशज्जिह्वायां, तासामधः षोडशाशस्त्रकृत्याः, **रसवहे द्वे वाग्वहे च द्वे ।**

सु.शा.७/२२

ii) Translation: Thirty six are in tongue, of which sixteen *Sira* are situated below; of them, two *rasavahe* and two *vaghvahe* are *Avedhya Sira*.

iii) Considered Site: Ant. 2/3 of inferior surface of the tongue.

Lingual and tonsillar artery present on the inferior surface of the tongue.

iv) Structures at considered site: Deep Lingual artery: Is the terminal part of the lingual artery and found in the inferior surface of the tongue near the frenulum.[61]

The root is supplied by the **tonsillar artery** a branch of facial artery[61]

v) Interpretation: So here we can consider Lingual artery and tonsillar artery as *Avedhya Sira.* (See Fig. 8.F. On page 100)

Jivha = Deep Lingual artery -2 + Tonsillar artery -2 =4

Thus there are total 4 Avedhya Sira at Jivha.

- ***Nasa*:**

i) *Sutra* in *devnagari:* द्विर्द्वादश नासायां, **तासामौपनासिक्यश्चतस्रः परिहरेत्, तासामेव च तालुन्येकां मृदावुद्देशे ।**

सु.शा.७/२२

औपनासिक्यः नासासमिपवर्तिन्यः। **सु.शा.७/२२(डल्हण टीका)**

ii) Translation: Twenty four *Sira* are in nose, of them four situated nearby *Nasa* and also one in palate's soft portion should be avoided.

The word औपनासिक्य means situated near by *Nasa*[62].

iii) Considered Site:

- ***Aaupnasike (Nasa samipvarti*)[62]*:*** near nose.
- ***Talu:*** soft palate.

iv) Structures at considered site: 1.Lateral nasal artery; is a branch of facial artery which supplies to the ala and dorsum of the nose[63].

2. Angular artery is a terminal part of facial artery; it runs up to the medial angle of the eye. (Near to the nose).[63]

Soft palate: is supplied by greater palatine branch of maxillary artery**.**[64]

v) Interpretation: So we can consider the angular artery, the lateral nasal branch of the facial artery and greater palatine branch of maxillary artery (either rt. Or lt.) as *Avedhya Sira*. (See Fig. 8. B. on page 97 and Fig. 8.E. On page 100)

Aaupnasik (Nasa samipvarti*) = *The angular artery - 2 + the lateral nasal branch of the facial artery- 2 = 4

Talu = Greater palatine branch of maxillary artery (either rt. Or lt.) - 1.

Total = 5

Thus there are total 5 Avedhya Sira at Nasa.

- ***Netra*:**

i) *Sutra* in *devnagari*: अष्टत्रिंशदुभयोर्नेत्रयोः **तासामकैकामपाङ्गयोः परिहरेत् ।** **सु.शा.७/२२**

ii) Translation: Thirty eight *Sira*, are present in both eyes of them, one in each *Apanga* should be avoided.

iii) Considered Site: *Apanga:* outer corner of eye[54]. (Outer canthus of eye.) *Apang* is type of *Sira Marma.*

iv) Structures at considered site: Zygomatico- orbital artery is branch of superficial temporal artery. (Present at outer canthus of eye)

Zygomatico-orbital artery: The zygomatico-orbital artery may arise independently from the superficial temporal artery or from its middle temporal or parietal branches. It runs close to the upper border of the zygomatic arch, between the two layers of temporal fascia, to the lateral orbital angle. It supplies orbicularis oculi and anastomoses with the lacrimal and palpebral branches of the ophthalmic artery. A well developed zygomatico-orbital artery is associated with a delayed division into frontal and parietal branches[30].

v) Interpretation: So, here we can consider Zygomatico- orbital artery as *Avedhya Sira*.
(See Fig. 8.C. On page 98)

Apanga* = *Zygomatico- orbital artery -1+1=2

Thus there are total 2 Avedhya Sira at Netra.

- ***Karna:***

i) *Sutra* in *devnagari*: कर्णयोर्दश, तासां **शब्दवाहिनीमेकैकां परिहरेत् ।** **सु.शा.७/२२**

ii) Translation: Ten *Sira,* are present in ears, of which the *Shabdavahi Sira* one on each side should be avoided.

iii) Considered Site: Ear: Auricle and external acoustic meatus.

iv) Structures at considered site: Auricular artery: The branches of the auricular artery are distributed to the lobule and lateral surface of the auricle and to the external acoustic meatus[30].

External acoustic meatus: Outer part is supplied by superficial temporal artery and the inner part, by the deep auricular branch of the maxillary artery.

v) Interpretation: So, here we can consider auricular branch of superficial temporal artery as *Avedhya Sira*. (This branch is nearer to the body wall)

Karna = Auricular branch of the superficial temporal artery -1+1= 2

Thus there are total 2 Avedhya Sira in Karna.

- ***Lalat*:**

i) *Sutra* in *devnagari:* नासानेत्रगतास्तु ललाटे षष्टिः, **तासां केशान्तानुगताश्चतस्रः, आवर्तयोरेकैका, स्थपन्यां चैका परिहर्तव्या ।** **सु.शा.७/२२**

ii) Translation: In *Lalat,* supplying nose and eyes are sixty *Sira*; of them, four are of *Keshant*, one each in two *Awarta* and one in *Stapani* should be avoided.

Iii) **Considered Site;**

- *Lalat*: -Forehead
- *Keshant*: -Margin of hair line.
- *Awarta*[54]: - Upper border of orbital cavity.(site of *Awarta Marma*)
- *Stapani*[54]:- In between two eyebrows. (site of *Stapani Marma)*

iv) Structures at considered site: Superficial temporal artery[30]: is the terminal branch of the external carotid artery. It begins, behind the neck of the mandible under cover of the

paratoid gland. It runs vertically upwards, crossing the root of the zygoma. About 5 cm above the zygoma, it divides into anterior (*Avarta)* and posterior branches (*Keshanta)* which supplies temple and scalp. The anterior branch anastomoses with the supraorbital and supratrochlear branches of the ophthalmic artery.

The supraorbital (*Keshant*) and supratrochlear (*Stapani*) are branches of ophthalmic artery which supplies the skin of the forehead[30].

v) Interpretation: So here we can consider posterior branch of superficial temporal artery, supraorbital artery, anterior (frontal) branch of superficial temporal artery and supratrochlear artery as *Avedhya Sira***.** (See Fig. 8.B. On page 97 and Fig. 8.C. On page 98).

Keshant = Posterior branch of superficial temporal artery-2 + Supraorbital artery-2= 4
Awarta =Anterior (frontal) branch of superficial temporal artery-2,
Stapani = Supratrochlear artery (Either rt. Or lt.)-1.
Total =7

Thus there are total 7 Avedhya Sira at Lalat.

- ***Shankha:***

i) *Sutra* in *devnagari:* शङ्ख्योर्दश, तासां **शङ्खसन्धिगतामेकैकां परिहरेत् ।** **सु.शा.७/२२**

ii) Translation: Ten *Sira,* are present in *Shankha Pradesh*: of them one each in *Shankha Sandhi* should be avoided.

iii) Considered Site: Above the ends of eyebrows and between forehead and ear[54]. (Site of *Shankha Marma)*

iv) Structures at considered site: Middle temporal artery is a branch of superficial temporal artery which runs on the temporal fossa deep to the temporalis muscle[30].

v) Interpretation: So we can consider Middle temporal artery as *Avedhya Sira***.** (See Fig. 8.C. On page 98)

Shankha Sandhigat = Middle Temporal artery -1 +1=2

Thus there are total 2 Avedhya Sira at Shankhsandhi.

- ***Shir:***

i) *Sutra* in *devnagari:* द्वादश मूर्धि, तासामुत्क्षेपयोर्द्वे परिहरेत्, सीमन्तेष्वेकैकाम् एकामधिपताविति एवमशस्त्रकृत्याः पञ्चाशज्जत्रुण ऊर्ध्वमिति ।। सु.शा.७/२२

ii) Translation: Twelve *Sira* are in *Shir*, of them two in *Utkshep*, one each in *Simanta* and one in *Adhipati* should be avoided. Thus above clavicles (*Urdhwa Jatrugat*) fifty *Sira* are *Avedhya Sira.*

iii) Considered Site:

- *Utkshep*[54]: -Margin of hear line above *Shankha Marma*.
- *Simanth*[54]:- Sutures
- *Adhipati*[54]:- Posterior Frontalle.

These all sites are *Marma sites* which are present in scalp region. So here we considered scalp region.

iv) Structures at considered site: Here we considered arterial supply of the scalp with emissary veins.

Arterial supply of scalp and superficial temporal region, In front of the auricle, the scalp is supplied from before backwards by the; **supratrochlear, supraorbital and superficial temporal arteries[30].**

The first two are branches of the ophthalmic artery which in turn is branch of the internal carotid artery. The superficial temporal is a branch of the external carotid artery.

Behind the auricle, the scalp is supplied from before backwards by the; **Posterior auricular and occipital arteries,** both of which are branches of the external carotid artery[30].

Thus, the scalp has a rich blood supply derived from both internal and the external carotid arteries, the two system anastomosing over the temple.

(Superficial temporal artery: is the terminal branch of the external carotid artery. About 5 cm above the zygoma, it divides into anterior and posterior branches which supplies temple and scalp.

Occipital artery: It ramifies on the back of the head, supplying the posterior half of the scalp.

Its branches in this region are: 1.Mastoid, 2. Meningeal and 3. Muscular. One of the muscular branches is large; it is called descending branch. It has superficial and deep branches. The deep branch descends between the semispinalis capitis and cervicis and anastoses with the vertebral and deep cervical arteries[30].

Posterior auricular artery: It supplies the back of the auricle, the skin over the mastoid process and over the back of the scalp. Its stylomastoid branch enters the stylomastoid foramen and supplies the middle ear, the mastoid antrum and air cells, the semicircular canals and the facial nerve.)[30]

Emissary veins connect the extra cranial veins with the intracranial venous sinuses. The parietal emissary vein passes through the parietal foramen to the superior sagittal sinus.[65]

Extracranial infections may spread through these veins to intracranial venous sinuses.

Supratrochlear, supraorbital arteries are not considered as *Avedhya Sira* in *Shir* as their maximum blood supply is to forehead *(Lalat)* and very minimal to scalp *(Shir).*

v) Interpretation: So here we can consider superficial temporal artery, occipital artery, posterior auricular artery and parietal emissary veins as *Avedhya Sira***.** (See Fig. 8.C. On page 98 and Fig. 8.G. On page 101)

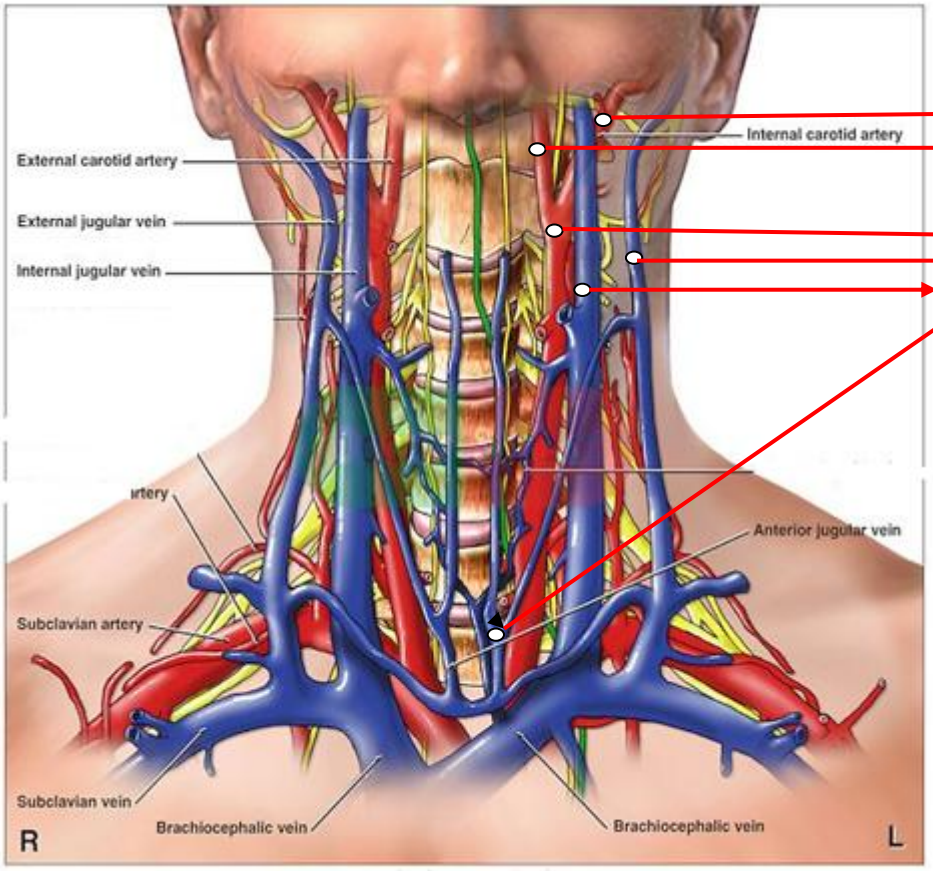
Shir = Superficial temporal artery-2, occipital artery-2, posterior auricular artery-2+ parietal emissary veins-2

Total= 8

Thus there are total 8 Avedhya Sira at Shir.

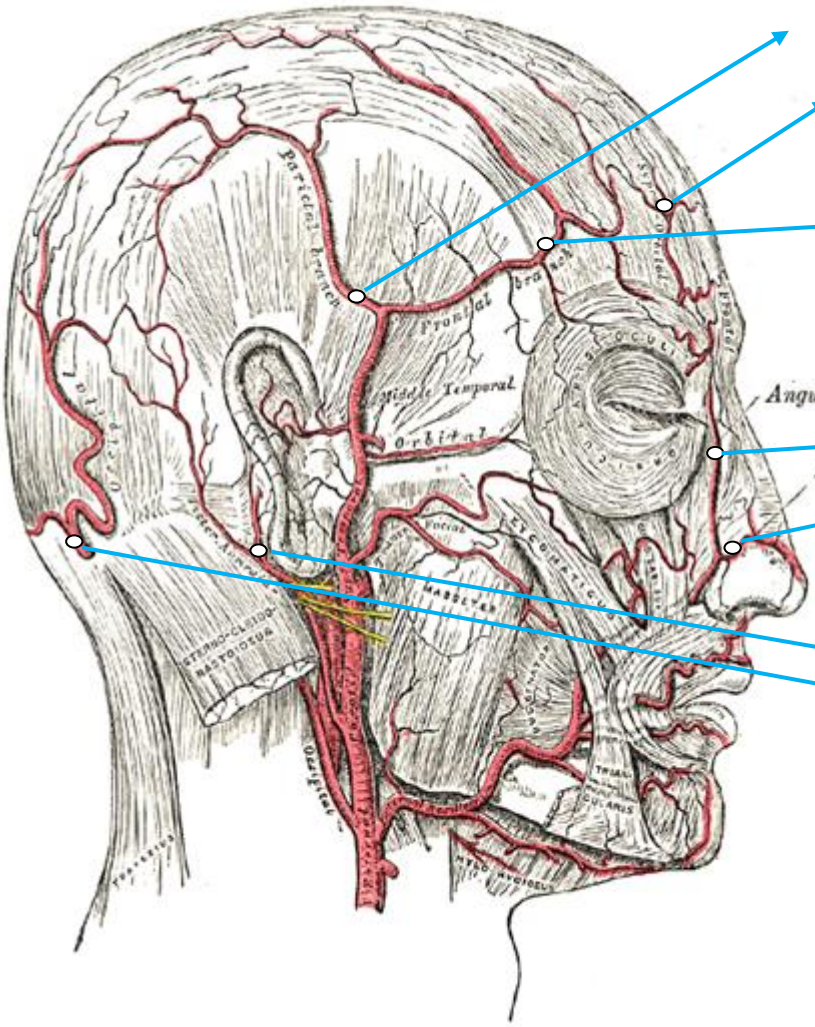
Fig: 8. *Urdhwajatru - Avedhya Sira*

Fig. 8. A. Anterior side of the Neck



Externa Jugular,
Internal Jugular &
Anterior Jugular veins
Comman carotid,
External carotid &
Internal carotid arteris
Griva
Nila, Manya & Matruka

Fig. 8. B. Arterial supply of Rt. Lat. aspect of face and scalp



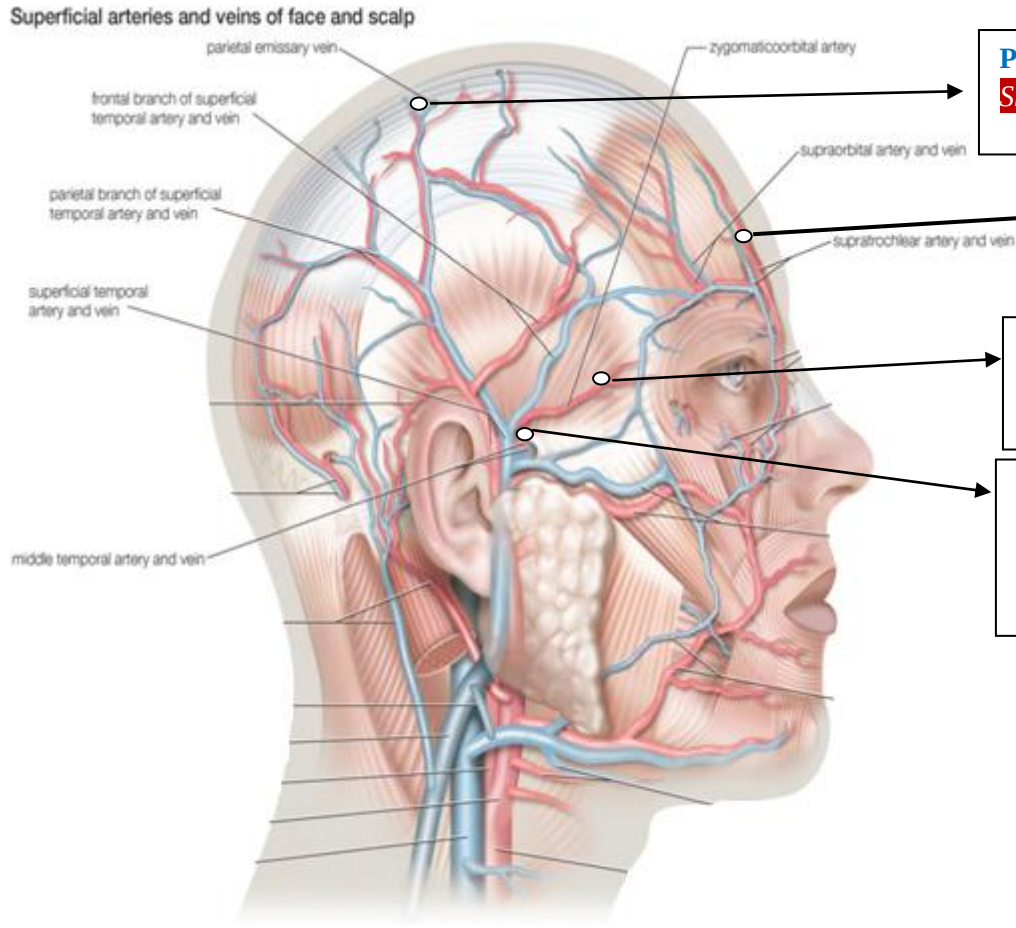
Posterior branch of Superficial temporal artery, Supraorbital artery
Lalat: *Keshantgata,*

Frontal (Ant.) branch of sup. Temp. Artery
Lalat: *Avarta*

Angular and lat. Nasal branch of facial Artery
Nasa: *Aupannasikya*

Occipital and Post. Auricular artery
Griva:
Krukatika Vidhur

Fig.8 .C. Blood supply of Rt. Lat. aspect of face and scalp



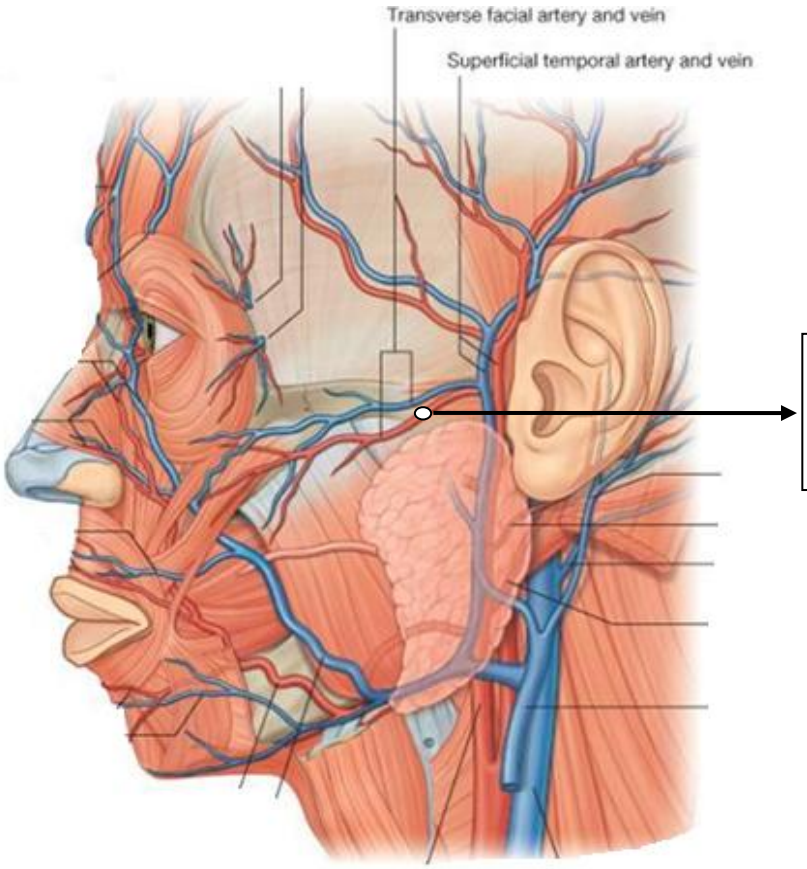
Parietal emissary veins
Shir

Supratrochlear artery
Lalat: Sthapani

Zygomatico-Orbital artery
***Netra**: Apanga*

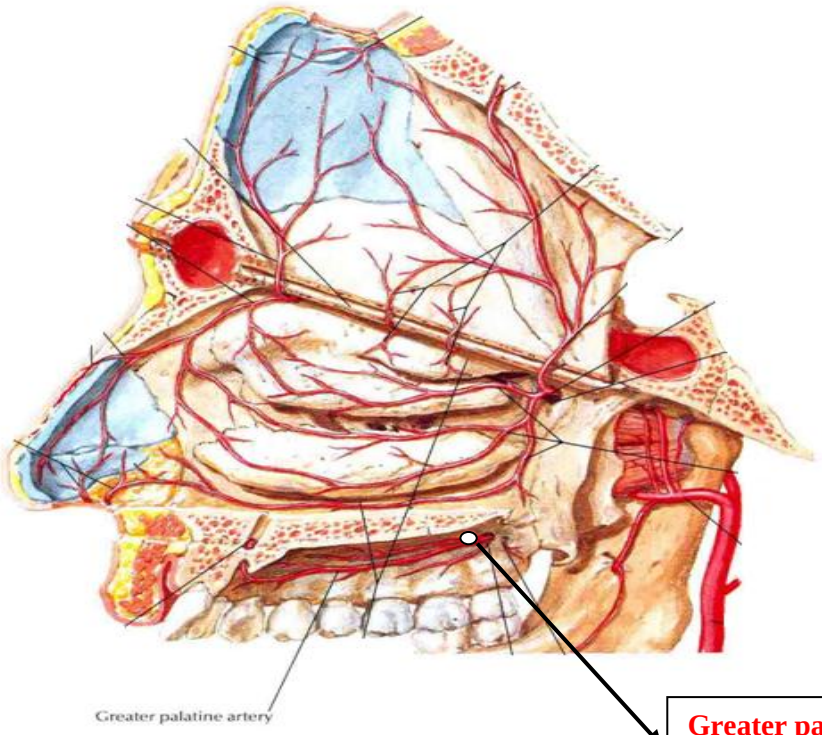
Middle Temporal artery
Shankha:
Shankhasandhigata

Fig. 8. D. Blood supply of Lt. Lat. aspect of face



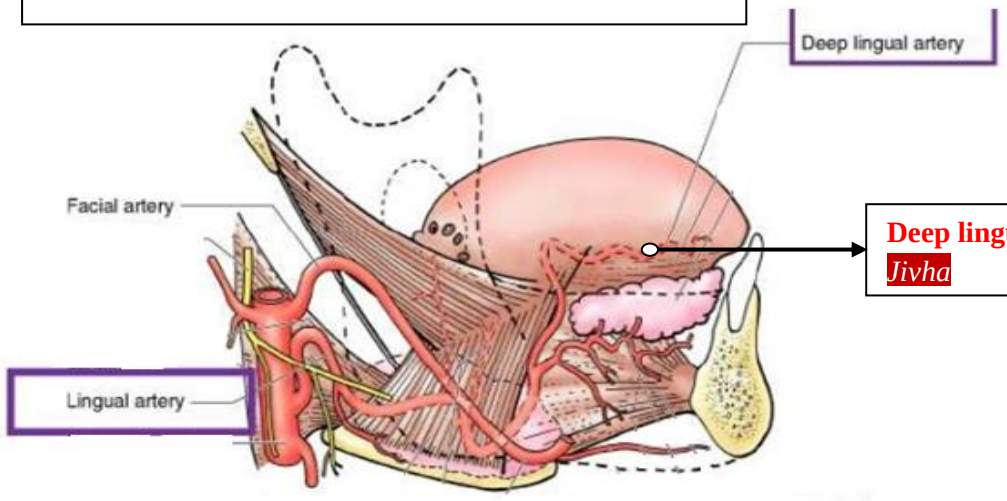
Transverse Facial artery
Hanu: *Sandhidhamani*

Fig. 8. E. Arterial supply of Hard and Soft palate



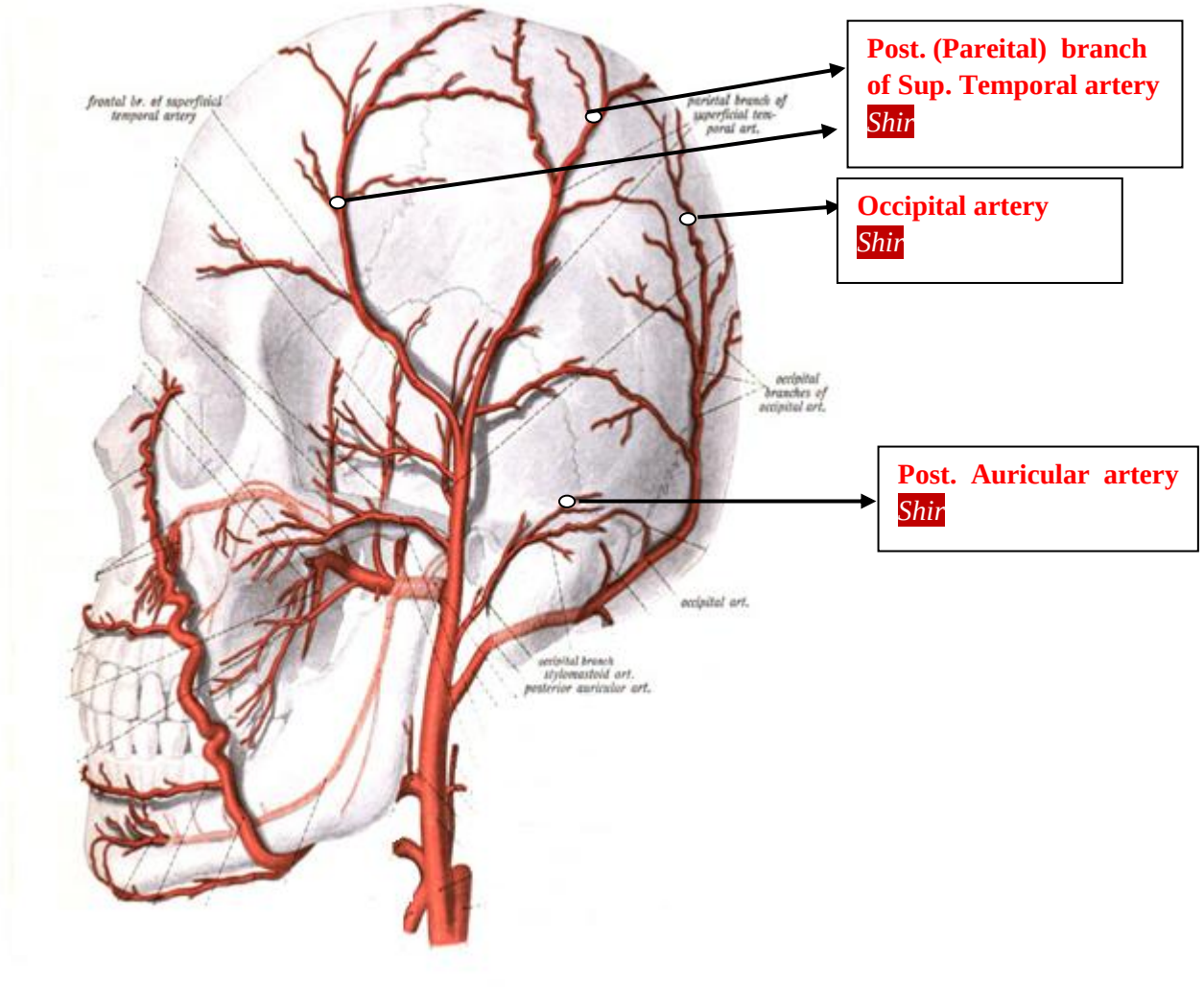
Greater palatine artery
Nasa: *Talugat*

Fig. 8. F. Arterial supply of Right side of Tongue.



Deep lingual artery
Jivha

Fig. 8. G. Arterial supply of Left lateral. Aspect of Scalp



4. Relation between *Avedhya Sira* and *Sira Marma*:

The *Sira Marma*[66]comes under either *Sadyapranhara or Kalantarpranhar or Vaikalyaka*ra types of *Marma*.[67]

Sira Marma	*Sadyapranhar Marma*	*Kalantarpranhar Marma*	*Vaikalykar Marma*
Nila			✓
Manya			✓
Matruka	✓		
Shrungataka	✓		
Apang			✓
Sthapani			
Fan			✓
Stanmul		✓	
Apalap		✓	
Apsthmbha		✓	
Hrudya	✓		
Nabhi	✓		
ParshwSandhi		✓	
Bhruhti		✓	
Lohitaksha			✓
Urvi			✓

अत ऊर्ध्वं प्रवक्ष्यामि न विध्येद्याः सिरा भिषक् ।।
वैकल्यं मरणं चापि व्यधात्तासां ध्रुवं भवेत् ।।१९।। सु.शा.७/१९

- As per reference from *Sushruta Samhita, vedhan of Avedhya Sira* leads to either grevious deformity (*Vaikalyakara Mama)* or death[68] (*Sadyapranhar Marma* and *Kalantarpranhar Marma*).
- Thus sites of *Sira Marma* can be co-related with sites of *Avedhya Sira.*

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B) <u>SURVEY STUDY:</u>

A preliminary discussion was made with various *Ayurveda* practitioners. They suggested adopting survey method of study to know whether the *Sushrutokta* sites of *Siravedha* are currently used in practice or not as well as probable underlying structure of *Vedhya* and *Avedhya Sira*.

So along with conceptual study, survey of *Siravedha* practicing *Vaidyas* is included in plan of work of this study.

Survey was carried out with the questionnaires.

1) <u>Questionnaire-A - For identification of *Siravedha* practicing *Vaidyas*.</u>

Questionnaire – A contains following questions-

i) Do you know *Siravedha* Practicing *Vaidyas*? Yes /No

ii) If yes, give name, address and contact number.

2) <u>Questionnaire-B - For survey of *Siravedha* Practicing *Vaidyas*</u>

Questionnaire-B (B-1 and B-2) was developed by incorporating the description of *Sushruta* and suggestions given by the committee and *Siravedha* practitioner*Vaidyas*:

- Whether Specific sites for *Siravedha* in particular *Vyadhi* described by *Sushruta* are used in practice or not? If not, then which sites were followed by *Vaidyas* for *Siravedha*?
- Do you know the underlying anatomical structure for site of *Siravedha*? If yes, then mention the name of structure.
- Do you know particular site described by *Sushruta* and underlying anatomical structure of *Avedhya Sira* or not? If yes, then mention name of site and structure.

The survey study was carried out in following manner:

- Questionnaire-A was given to 40 staff and 400 students from B.V.D.U. College of Ayurved, Pune and 10 *Vaidyas* practicing in Pune.
- The data of 155 *Siravedha* practicing *Vaidyas* from all over India was obtained through this Questionnaire -A.
- Questionnaire-B was sent to these 155 *Vaidyas* all over the India who are practicing *Siravedha*.
- Out of 155 *Vaidyas,* we received Questionnaire feedback from 100 *Siravedha* practicing *Vaidyas*.
- By communicating with these 100 *Vaidyas*, we tried to identify different schools of *Siravedha* practice which they follow.

C) <u>RETROSPECTIVE STUDY OF DOCUMENTED POST MORTEM CASE REPORT:</u>

Retrospective post mortem case study has been carried out at Department of Forensic Medicine and Toxicology of Sasoon Hospital, Pune on 6th and 14th Sept. 2012 and reviewed 306 post mortem cases regarding their cause of death because of single structure injury, multiple injuries and/or head injury with the intention to find out whether death is due to injury to *Avedhya Sira* or not.

OBSERVATIONS

A) OBSERVATIONS BASED ON CONCEPTUAL STUDY

1. Observations based on Comparison of *Sira* with Vessels:

According to *Ayurveda*, *Sira* nourishes the body[1] and as per the modern science body is nourished by blood vessels and lymphatics.[2]

Hence we can correlate the *Sira* with the blood vessels and Lymphatics.

On the basis of colour, types of *Sira* can be correlated with the following types of vessels.[4,7,9]

1. *Aruna Sira* can be correlated with Capillaries.
2. *Neela Sira* can be correlated with Veins.
3. *Gauri Sira* can be correlated with Lymph vessels.
4. *Rohini Sira* can be correlated with Arteries.

2. Observations regarding the Interpretative sites of *Vedhya Sira*:

The site of *Siravedha* can be interpretive with the modern anatomical structures listed in tables. Here, we have considered superficial veins and tributaries of veins which are not superficial at that particular site as *Vedhya Sira*.

Adhoshakha* - Interpretative sites of *Vedhya Sira

S. N.	*Vyadhi*[10]	*Sushrutokta* sites for *Siravedha*[10]	Modern structure and site
1	*Padadaha, padharsha,chippa, visarpa, vatkantak, vicharchika,padadari* etc.	*2 Angula* above *Kshipra Marma* by *Vrihimukha*	Begining of great saphenous vein.2 *angula* above from point between Great toe and first little toe.[12]
2	*Shlipada*	*4 Angula* above or below *Gulpha*	Great saphenous vein 4 *angula* above or below from ankle joint[12].
3	*Kroshtukashirsha, Khanja, pangu, vatvedana*	*4 Angula* above *Gulpha*	Great saphenous vein 4 *angula* above from the ankle joint.[12]
4	*Apachi*	*2 Angula* below *Indrabasti*	Small saphenous vein 2 *angula* below the *Indrabasti Marma*[14].
5	*Grudhrasi*	*4Angula* above or below *Janu*	Great saphenous vein. 4 *angula* either above or below the Knee joint.[12]
6	*Galganda*	*Sira* of *Urumula*	The superficial epigastric veins, The superficial circumflex iliac veins[15]

Urdhwashakha* - Interpretative sites of *Vedhya Sira

S. N.	***Vyadhi*[10]**	***Sushrutokta* sites for *Siravedha*[10]**	**Modern structure and site**
7	*Pliha Vriddhi*	Inner side *of Kurpara Sandhi (*at the centre of *vaama-Bahu)* OR at middle of left *Kanistika and Anamika*	Median cubital vein of the left side[16].or left dorsal digital veins[17](in-between little and ring finger)
8	*Yakrudakhya*	Inner side *of Kurpara Sandhi (*at the centre of *Dakshina-Bahu)* OR at middle of right *Kanistika and Anamika*	Median cubital vein of the right side[16].or right dorsal digital veins[17](in-between little and ring finger)
9	*Kasa – Shwasa*	Inner side *of Kurpara Sandhi* (at the centre of *Dakshina-Bahu)* OR at middle of right *Kanistika and Anamika*	Median cubital vein of the right side[16].or right dorsal digital veins[17](in-between little and ring finger)
10	*Vishvachi*	*4 Angula Pradesh* above or below *Kurpar Sandhi*	Cephalic and basalic veins,[18]4 *angula* above or below the elbow joint.

Madhya Sharir* - Interpretative sites of *Vedhya Sira

S. N.	*Vyadhi*[10]	*Sushrutokta* sites for *Siravedha*[10]	Modern structure and site
11	*Shulayukta Pravahika*	2 *Angula* nearby *Shroni*	The superficial epigastric veins.The superficial circumflex iliac veins[15], Superior gluteal veins, Inferior gluteal veins.[19]
12	*Parivartika, Updamsha, Shukadosa,* diseases of *Shukra*	Middle of *Shishna*	Superficial dorsal vein of the penis[20]
13	*Mutravriddhi*	*Parshava* of *Vrishana*	Tributaries of Superficial external pudendal veins[21].
14	*Jalodar*	Left to *sevani* located 4 *Angula* below umbilicus	Left superficial epigastric vein[15]
15	*Antar-Vidradhi* and *Parshva-Shula*	At centre of *Kaksha* and *Stana* at *Vaama-Parshva*	Left lateral thoracic vein[22]
16	*Bahushosha* and *Avabahuka*	In between 2 *Ansa*	Superficial branch of transverse cervical vein[24]
17	*Tritiyaka Jvara*	*Madhya Sira* of *Trika Sandhi*[40]	Dorsal scapular vein (or deep branch of transverse cervical vein)[22]
18	*Chaturthaka Jwara*	*Sira* of either right or left *Parshwa* located below *Skandha Sandhi*	Thoracodorsal vein[22]

Urdhwa Jatru* - Interpretative sites of *Vedhya Sira

S.N.	*Vyadhi*[10]	*Sushrutokta* sites for *Siravedha*[10]	Modern structure and site
19	*Apasmara*	Middle of *Hanu Sandhi*	Transverse facial vein[27]
20	*Unmada*	*Sira* of *Shankha* and *Keshanta Shandhi.* Also *Sira* of *Ura, Apanga, lalat*	The superficial temporal vein (frontal branch)[28] Ant. Cutaneous and Lat. Cutaneous Veins of thoracic wall[29], Zygomatico-Orbital vein[30], The supratrochlear and supraorbital veins[31].
21	*Jivha* and *Danta roga*	*Sira* below *Jivha*	Deep lingual vein[32]
22	*Talu Roga*	*Talu*	Greater palatine veins[33]
23	*Karna Shula* and *Karna Roga*	Above and around the *Karna*	Superficial temporal vein[28] , Posterior auricular vein[28]
24	*Nasa Roga*	*Agrabhaga* of *Nasa*	The veins form plexus which drains anteriorly into facial vein[35].
25	*Timira, Akshipaka,* etc.	Near by *Nasa, Lalat,* at *Apang*	Angular vein[36]. The superficial temporal vein[28], The supratrochlear vein, Supraorbital vein[31]. Zygomatico-orbital vein[30].
26	*Shiroroga, Adhimantha* etc.	Near by *Nasa, Lalat,* at *Apang*	Angular vein[36]. The superficial temporal vein[28], The supratrochlear vein, Supraorbital vein[31]. Zygomatico-orbital vein[30].

3. <u>Observations regarding the interpretative sites of *Avedhya Sira*</u>*:*

The name and site of *Avedya Sira* can be interpretative with the following anatomical structures listed in tables. Here, we have considered terminal part of some specific superficial veins having many tributaries, arteries and larger veins present nearer to body wall as *Avedhya Sira*.

***Urdvashakha* and *Adhoshakha - Avedhya Sira*:**

Sthan[36]	**Name of *Sira***[36]	***Sankhya***[36]	**Modern structure and Number**
***Adhoshakha* (8)**	*Jaladhara*	1 (in each *Shakha*) x 2 = 2	*Terminal part(near saphenous opening) of Great saphenous vein*[12] (1+1) =2
	Urvi	2 (in each *Shakha*) x 2 = 4	Femoral artery[38] (1+1) =2 + Profunda femoris artery[39](1+1)=2 total= 4
	Lohitaksha	1 (in each *Shakha*) x 2 = 2	Femoral vein[40](1+1)=2
***Urdhwashakha* (8)**	*Jaladhara*	1 (in each *Shakha*) x 2 = 2	Terminal part (near delto pectoral groove) of Cephalic vein[18] (1+1)=2
	Urvi	2 (in each *Shakha*) x 2 = 4	Brachial artery[48](1+1)=2 + Profunda brachi artery[54](1+1)=2 total= 4
	Lohitaksha	1 (in each *Shakha*) x 2 = 2	Axillary vein[42](1+1)=2
		Total =16	**Total =16**

***Madhya Sharir - Avedhya Sira*:**

Sthan[36]	**Name of *Sira***[36]	***Sankhya***[36]	**Modern Structure and Number**
***Shroni* (8)**	*Vitapgat*	2+2 = 4	Superficial external pudendal artery[43]1+1=2 Superficial epigastric artery [43]1+1=2 **Total = 4**
	Katiktarun	2+2 = 4	Superior glutial artery[46] 2+ Inferior glutial artery[46] 2= 4 **Total = 4 + 4 = 8**
***Parshva* (4)**	*Urdhvaga*	2	Thoracodorsal artery[48] 1+ 1= 2 ,
	Parshva-Sandhigat	2	Non specific cutaneous arteries 1+1 =2 **Total 2+2=4**
***Prushtha*(2)**	*Bhruhati*	2	The circumflex scapular artery anastomosis with deep branch of the transverse cervical artery at the inferior angle of the scapula. Anastomosis area[49] Rt.1 + Lt. 1 **= 2**
***Udara* (4)**	*Medhropari Romraji Ubhayata*	2+2 = 4	Inferior epigastric artery [50]2+ Inferior epigastric vein[50] 2= **4**
***Vaksha* (14)**	*Hrudya*	2	Internal thoracic artery[52] 1+1= **2,**
	Stanamool	2+2 = 4	Musculophrenic artery[52] 2 + Superior epigastric artery[52] 2=**4**
	Stanarohit Apalap Apastmbha	0n each side of *Stanrohit, Apalap & Apastmbha* there are 8 *Sira*	Superior thoracic[53] 2. Thoraco acromial[53] (Thoraco part 2 and acromial part 2) 4. Lateral thoracic artery[53] 2. Total= **8** **Total-2+4+8 = 14**
		Total=32	**Total = 32**

Urdhwajatru - Avedhya Sira:

Sthan[36]	***Name of Sira***[36]	***Sankhya***[36]	**Modern Structure and Number**
***Griva* (16)**	*Nila* *Manya* *Matruka*	2 2 8 Total=12	External jugular vein 2 +Internal jugular vein 2 +Anterior jugular vein 2[56] + Common carotid artery 2 +External carotid artery 2 + Internal carotid artery 2 [55] Total =**12**
	Krikatika	2	*Occipital artery* [57] **2**
	Vidhura	2	Posterior auricular artery[57] **2** **Total = 12+2+2 = 16**
Hanu (4)	*Sandhi dhamanis*	2+2 = 4	Transverse facial artery[59]- 2 + Branch of superficial temporal artery[60] **1+1=2** T**otal = 4**
***Jivha* (4)**	*Rasvahe 2 + Vagvahe2*	2+2=4	Deep lingual artery ***2*** **+** Tonsillar artery ***2*** [61]***= 4***
***Nasa* (5)**	*Aupannasikya* 4+ *Talugat* 1	4 +1 = 5	The angular artery[63]**2** + Lateral nasal branch of the facial artery[63] **2 = 4 +** Greater palatine branches of maxillary artery[64]**1**. ***Total = 5***
***Netra* (2)**	*Apanga*	1+1=2	Zygomatico- orbital artery[30]**1+1=2**
***Karna* (2)**	*Shabdavahi*	2	Auricular branch of the Superficial Temporal artery[30]**1+1= 2**
***Lalat* (7)**	*Keshantgata*	4	Posterior branch of superficial temporal artery[30] ***2*** **+** Supraorbital artery[30] **2= 4**
	Avarta	2	Anterior branch of superficial temporal artery[30]***1+1=2***
	Sthapani	1	Supratrochlear artery[30](either rt. Or lt.***) - 1*** **Total - 4+2+1=7**
Shankha (2)	*Shankha Sandhigata*	2	Middle temporal artery[30]**- 2**
Shir	*Utkshepa* *Simant* *Adhipati*	2 5 1 Total = 8	Posterior branch of Superficial temporal artery[30] 2,+ Occipital artery[30] 2, + Posterior auricular artery[30] 2+ Parietal emissary veins[65] 2 = **Total = 8**
		Total=50	**Total=50**

4. <u>Observation based on *Marma Sharir*</u>:-

The sites of *Sira Marma* are the sites of *Avedhya Sira*.

(References: The references given in the observation of conceptual study should be seen in references of conceptual study.)

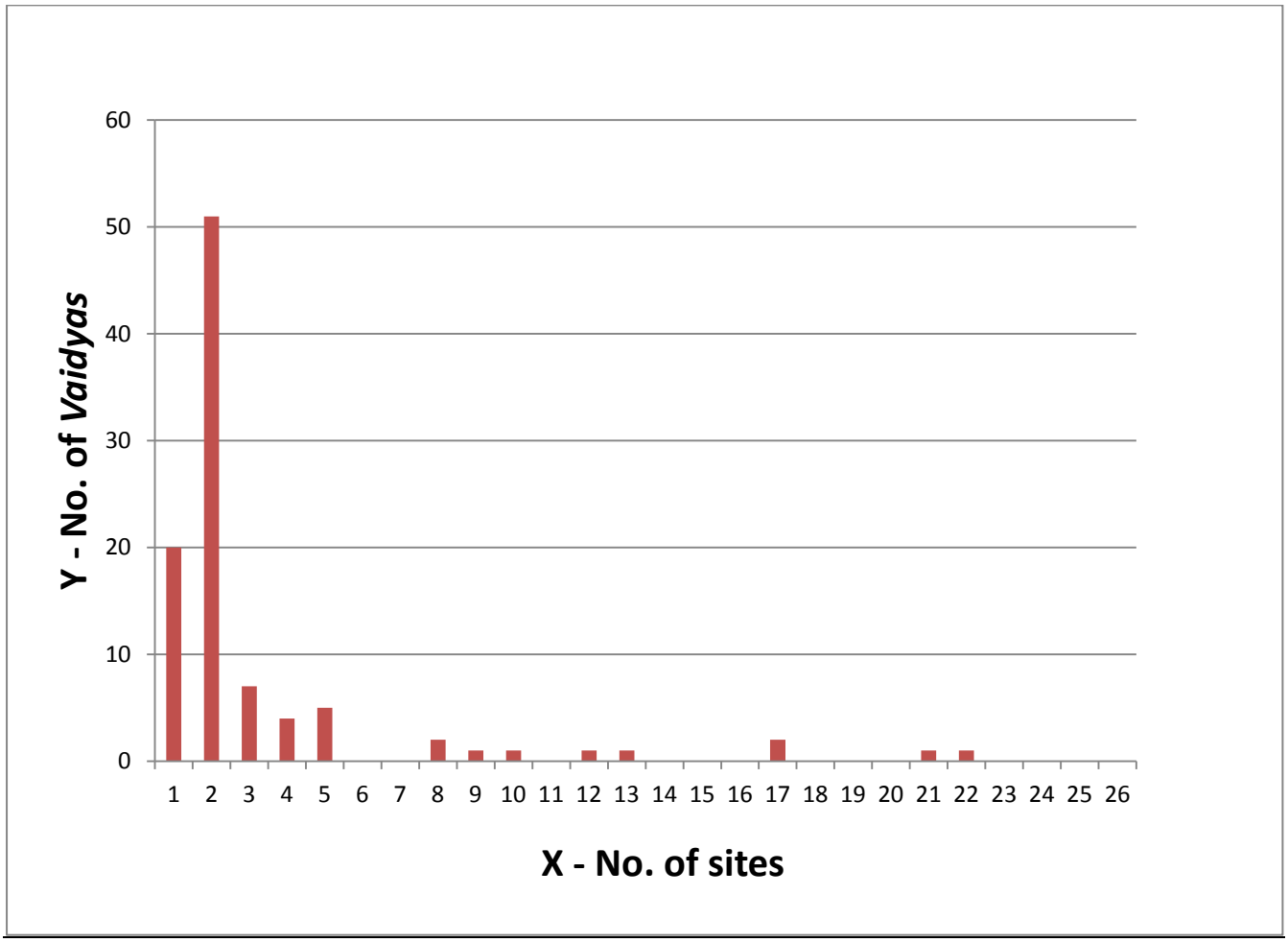
B) OBSERVATIONS BASED ON SURVEY STUDY:

Observation Table No.1-A No. of sites used by *Vaidyas* out of 26 sites mentioned by *Sushruta*.

S. N.	Number of sites used by *Vaidyas* out of 26 sites	Total number of *Vaidyas*
1	1	20
2	2	51
3	3	7
4	4	4
5	5	5
6	6	0
7	7	0
8	8	2
9	9	1
10	10	1
11	11	0
12	12	1
13	13	1
14	14	0
15	15	0
16	16	0
17	17	2
18	18	0
19	19	0
20	20	0
21	21	1
22	22	1
23	23	0
24	24	0
25	25	0
26	26	0
		Total = 100

From the above table it is observed that none of the *Vaidyas* used entire 26 sites for *Siravedha*. Only one *Vaidya* has used maximum 22 sites in his practice. While other *Vaidyas* are doing *Siravedha* at limited sites.

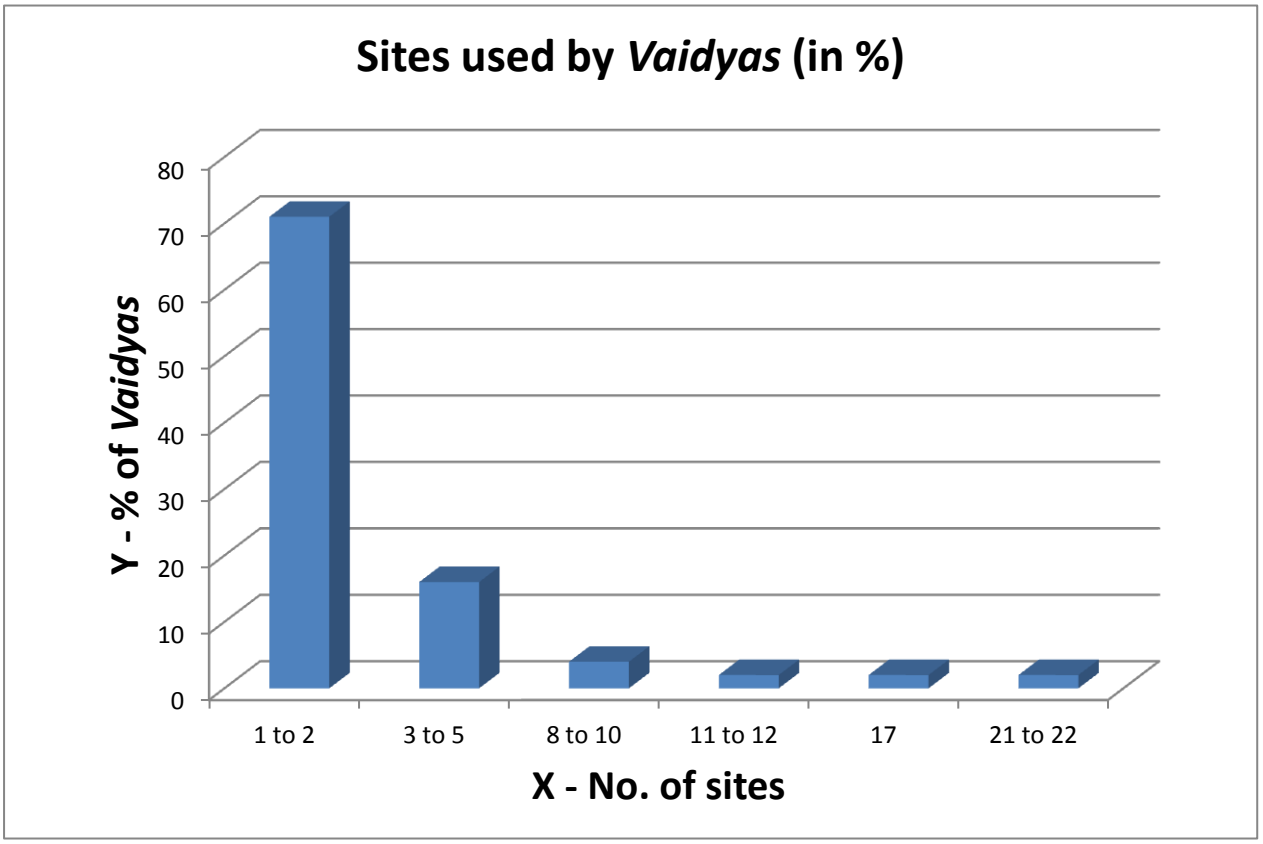
Graphical presentation of No. of sites used by *Vaidyas* out of 26 sites



Observation table No.1-B: Sites used by *Vaidyas* (in %) out of 26 sites mentioned by *Sushruta.*

S. N.	No. of Sites used by *Vaidyas* out of 26 sites	% of *Vaidyas*
1	1 to 2	71
2	3 to 5	16
3	8 to 10	04
4	11 to 12	02
5	17	02
6	21 to 22	02

In survey study of 100 *Vaidyas* from all over India, 71 % are doing *Siravedha* at 1-2 site, 16 % at 3-5 sites, 4% at 8-10 sites, 2 % at 11-12 sites, 2% at 17 site and 2% at 21-22 sites.



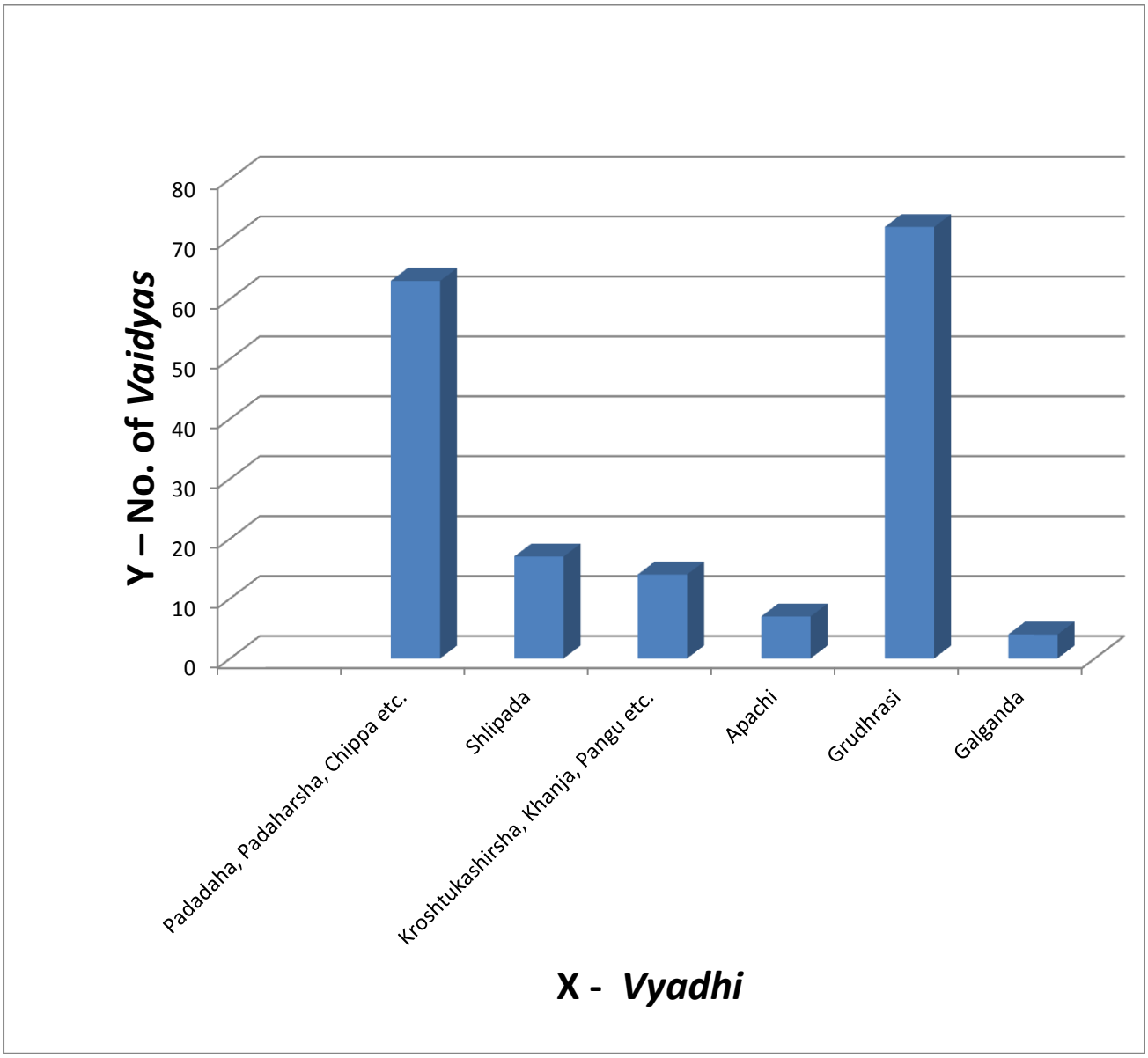
Observation Table No. 2

No. of *Vaidyas* practicing *Siravedha* in particular *Vyadhis* among 100 *Vaidyas*

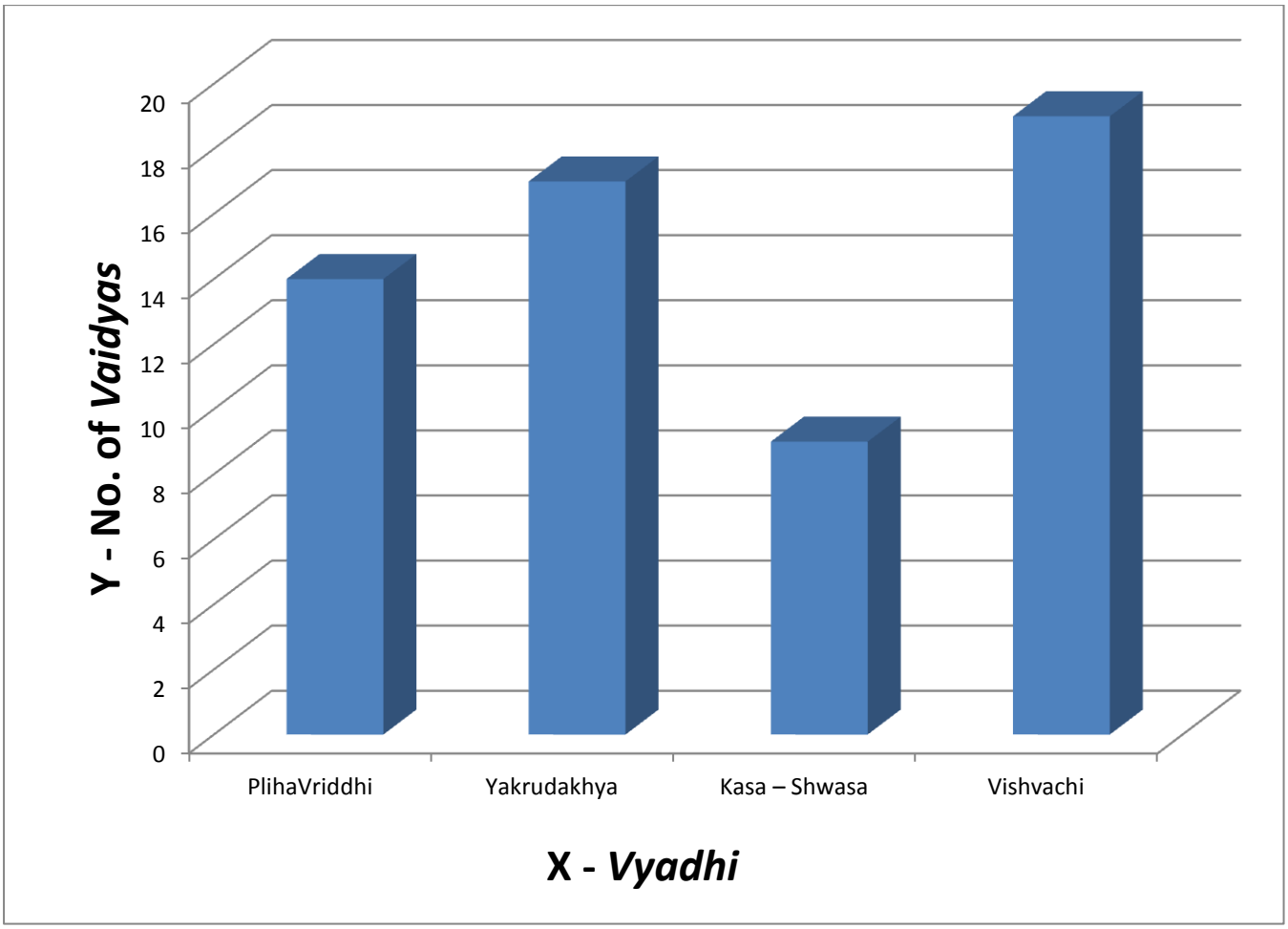
S. N.	*Vyadhi*	No. of *Vaidyas* doing *Siravedha*
1	*Padadaha, Padaharsha, Chipp, Visarpa, Vatkantak, Vicharchika, Padadari*	63
2	*Shlipada*	17
3	*Kroshtukashirsha, Khanja, pangu, vatvedana*	14
4	*Apachi*	7
5	*Grudhrasi*	72
6	*Galganda*	4
7	*PlihaVriddhi*	14
8	*Yakrudakhya*	17
9	*Kasa – Shwasa*	9
10	*Vishvachi*	19
11	*Shulayukta Pravahika*	4
12	*Parivartika, Updamsha, Shukadosa, Diseases of Shukra*	4
13	*Mutravriddhi*	3
14	*Jalodar*	5
15	*Antar-Vidradhi and Parshva-Shula*	4
16	*Bahushosha and Avabahuka*	8
17	*Tritiyaka Jwara*	1
18	*Chaturthaka Jwara*	1
19	*Apasmara*	5
20	*Unmada*	7
21	*Jivha* and *Dantaroga*	1
22	*Talu Roga*	3
23	*Karna Shula and Karna Roga*	8
24	*Nasa Roga*	5
25	*Timira, Akshipaka* etc.	3
26	*Shiroroga, Adhimantha* etc.	7

From the above tables it is observed that most of the *Vaidyas* are doing *Siravedha* in ***Grudhrasi, Padadaha, and Padaharsha*** *Vyadhis*.

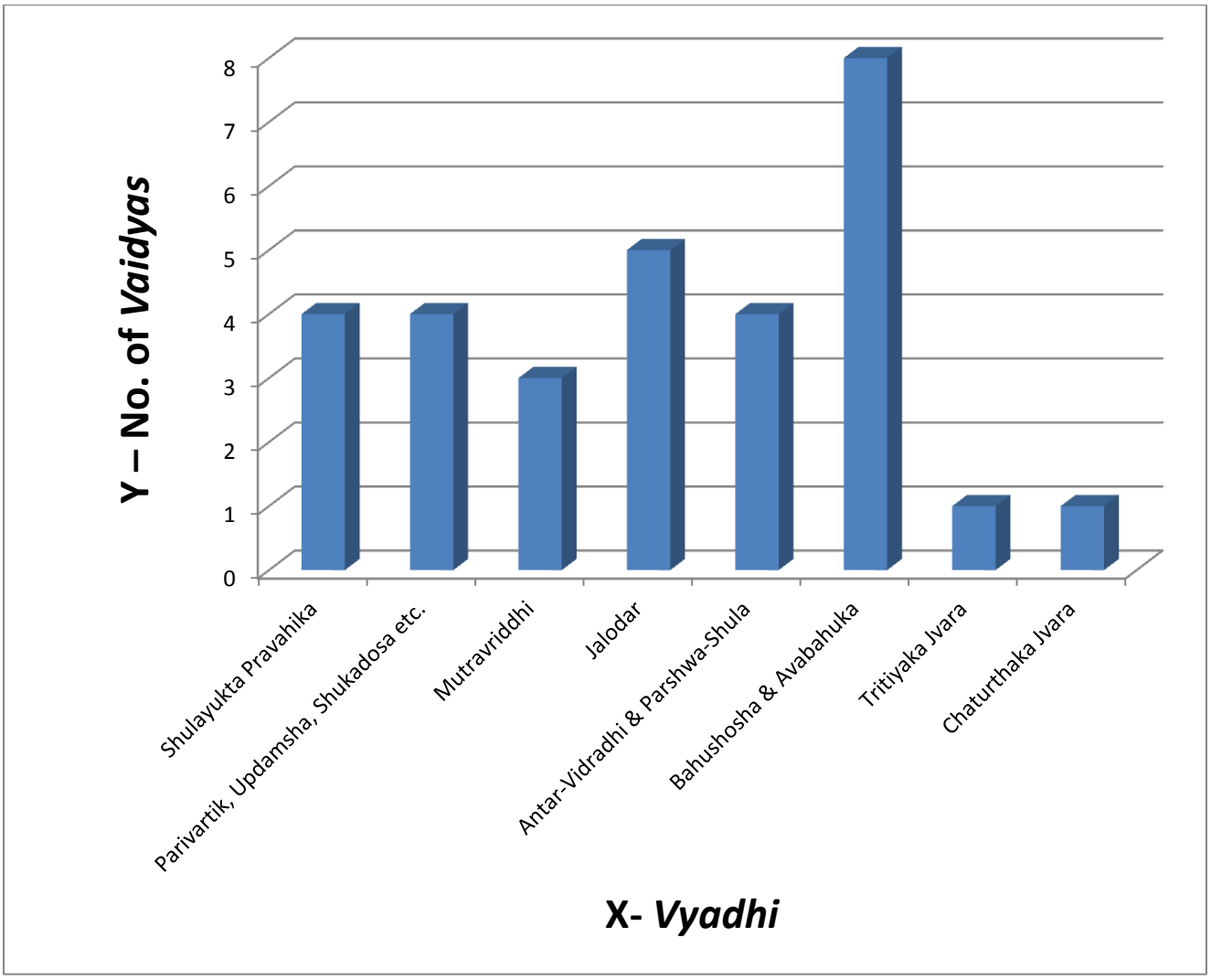
No. of Vaidyas doing *Siravedha* in *Adhoshakha*



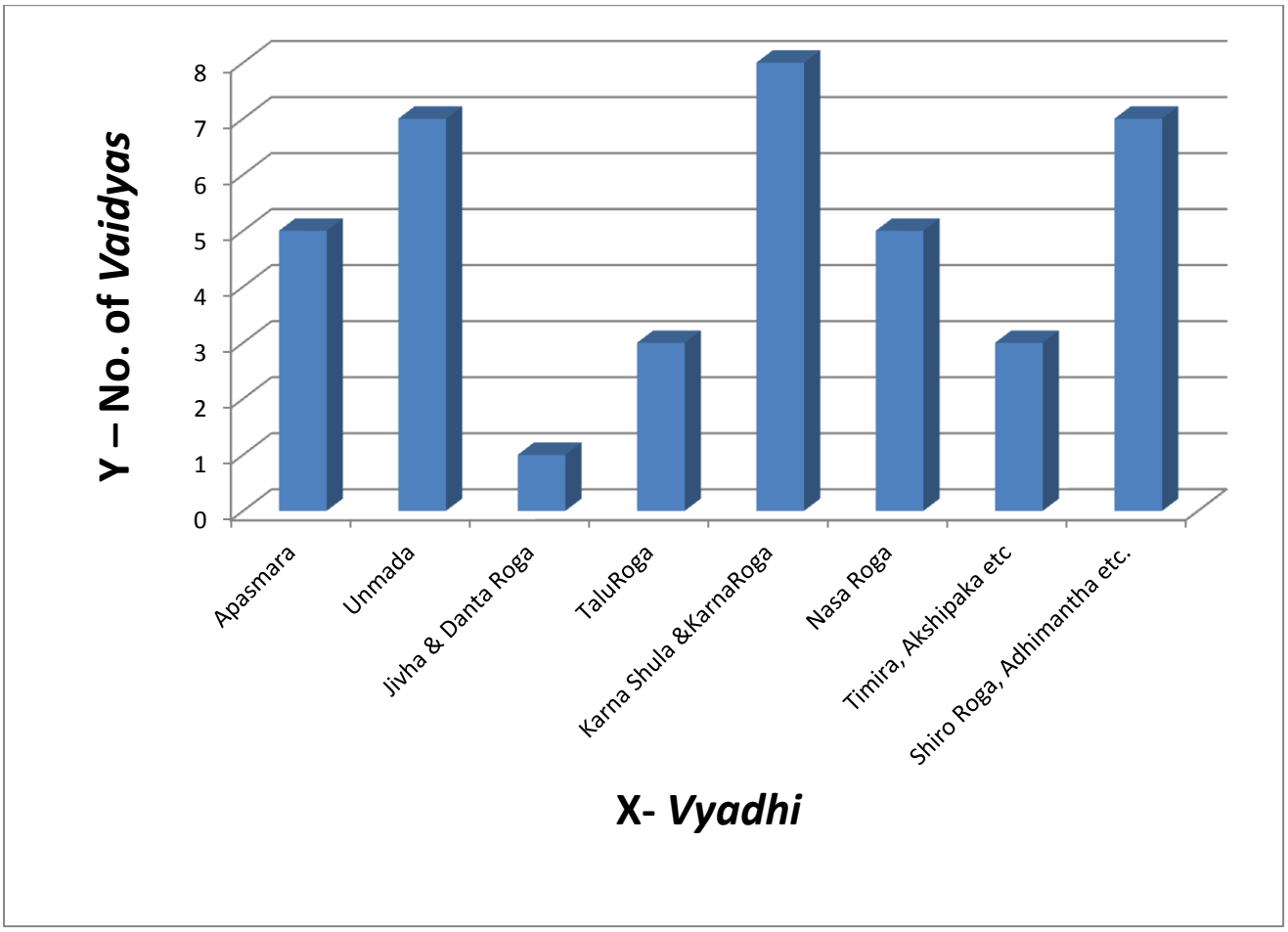
No. of Vaidyas doing *Siravedha* in *Urdhwashakha*



No. of Vaidyas doing *Siravedha* in *MadhyaSharir*



No. of *Vaidyas* doing *Siravedha* in *Urdhwajatru*



Observation table No.3.A.- Number of schools of thoughts of *Siravedha* practicing *Vaidyas* found through survey study

1	Vd. R. B. Gogate (Pune, Maharashtra)
2.	Vd.P. T. Joshi (Dhule, Maharashtra)
3.	Vd. Shrinivas Acharya (Udupi, Karnataka)
4.	Vd. Ramesh Rajguru (Ahmadnagar, Maharashtra)
5.	Vaidyas performing with their own method (All over India)

Observation table No.3.B - No. of *Vaidyas* belonging 5 different schools.

S.N.	Name of schools of thoughts of *Siravedha*	No. of *Vaidyas* under it
1	Vd. R.B. Gogate (Pune, Maharashtra)	36
2.	Vd. P. T. Joshi (Dhule, Maharashtra)	21
3.	Vd. Shrinivas Acharya (Udapi, Karnataka)	6
4.	Vd. Ramesh Rajguru (Ahmadnagar, Maharashtra)	4
5.	Vaidyas performing with their own method (all over India)	33
	Total=	100

Observation table No.3.C. – Details regarding *Siravedha* method of 5 different schools of thoughts

Name of school of thoughts	Basic Reference of *Siravedha*	Consideration of *Vedhya Sira* as------	Specific name of superficial Vein	Instrument Utilized	*Siravedha* performed at no. of sites	Blood quantity Unit
Vd. Gogate	*Sushruta*	Superficial Veins	Not specified	Scalp van. No. 18/20 Needle no. 26	15-22	Automatic stoppage of blood
Vd. Joshi	*Sushruta*	Superficial Veins	Not specified	Needle No.18	15-20	Automatic stoppage of blood
Vd. Acharya	*Vagbhat*	Superficial Veins	Not specified	Scalp van. No. 20/21	3-6	50-100ml
Vd. Rajguru	*Sushruta/ Vagbhat*	Superficial Veins	Not specified	Needle 1 inch	3-5	20-30ml
***Vaidyas* performing with their own method**	*Sushruta/ Vagbhat*	Superficial Veins	Not specified	Scalp van. No. 18/20 various size of Needles	1-7	Not specified

The Overall Observations seen after Completion of Survey Study:

a) None of the *Vaidyas* are doing *Siravedha* at all sites.

b) In survey study of 100 *Vaidyas* from all over India, 1-2 sites are used by maximum *Vaidyas* i.e.71% and few *Vaidyas* are doing *Siravedha* at more than 10 sites.

c) Most of the *Vaidyas* (60-70%) are doing *Siravedha* in *Grudhrasi, Padadaha, Padaharsha Vyadhis* whereas only 1% is doing *Siravedha* in *Tritiyak Jwar, Chaturthak Jwar, Jivha and danta roga*.

d) The commonly used sites for *Siravedha* are nearby *Gulpha, Janu and Kurpar*.

e) All these *Vaidyas* from different schools are using superficial veins for *Siravedha* but not knowing the name of that particular superficial vein.

f) There is no any information available regarding the instance of complications due to puncture of *Avedhya Sira* in the practice from this survey feedback.

g) Instead of *Siravedha*, most of the *Vaidyas* are using alternative method of *Raktamokshan* like *Jalaukavacharan* at specified sites.

C) OBSERVATIONS BASED ON RETROSPECTIVE STUDY OF DOCUMENTED POST MORTEM CASE REPORT:

While studying these post mortem cases, it is observed that, a single structure damaged (any artery or vein i.e. *Avedhya Sira*) leading to death was not found, rather the causes of death were because of multiple injuries and/or damaged multiple structures.

Though injury to one *Avedhya Sira* can be fatal but same is not found in above 306 cases.

DISCUSSIONS

The probable confirmation of anatomical structure for *Vedhya* and *Avedhya Sira* has been discussed on the basis of interpretation of observations drawn from

I) Conceptual study

II) Survey study and

III) Retrospective study of Documented Post mortem Case report

I) DISCUSSION ON THE BASIS OF CONCEPTUAL STUDY

1. Comparison between *Sira* and vessels:

According to *Charaka* and *Vagbhata, moola sthan* of *Sira* is *Hrudya*[1,2]

Charaka stated that *Moola Sira* are ten in number, which called as *Mahamula* and they originating from *Hrudya* conveying *Oja* all over the body[1]. According to *Vagbhata* also *Moola Sira* are ten in number. They are originating from *Hrudya*, spread all over the body. It conveys *rasrup Oja dhatu* all over body[2].

As per modern anatomy, main arteries and veins are originated from heart[3]. Thus arteries and veins can be considered as *Sira* and heart i.e. *Hrudya* as their moola *sthan*.

Thus with above support we have considered *Sira* as vessels.

According to *Sushruta,* the *moola sthan* of *Sira* is *Nabhi*[4]. In the 7th chapter of *Sharirsthan Sushruta* said that, *Sira* originating from umbilicus spread and pervade all around in the body as branches of stem etc. from the lotus stock spread in water[5]. According to modern, the arteries and veins are not originating from umbilicus, so here a controversy arises regarding consideration of *Sira* as vessels on the basis of origin.

But this controversy can be resolved by considering the function, distributions and types of *Sira* stated by *Sushruta* which are similar with that of vessels.

For this, we went through references regarding functions, distributions and types of *Sira*.

A) Function of *Sira* and vessels:

As stated in *Sushruta Samhita,* the body is nourished by *Sira*.

(The body is nourished by 700 *Sira* like garden by water-carriers and like field by irrigating channels and also benefitted with activities such as contraction, extension etc.)[4]

As per modern anatomy nourishment of body is through blood vessels and lymphatics.

(The nutrients, oxygen, hormones, etc. are carried out throughout the body by cardiovascular system through vessels[6].)

Therefore on the basis of similarity in function i.e. nourishment *Sira* are considered as vessels.

B) On the basis of distribution of *Sira* and vessels:

Sushruta stated that the ramifications of *Sira* are like venation in a leaf, their root is at umbilicus from that site they spread upwards, downwards and obliquely[4]. According to him *Mool Sira* carring *dosha* are 40 i.e. *Vatavahi, Pittavahi, Kaphavahi, Raktavahi* –each 10 in number. These *Sira* run in their particular *sthana* and each divided and redivided into 175 branches. Therefore total *Sira* are 700[9].

According to ***Ashtang Sangraha*** and ***Ashtang Hrudya,*** ten *Mool Sira* (root veins) which are connected to the heart, transport *Oja* to all the major and minor parts of body.[7] They are big at their roots and very small at their tips and appear like the lines of leaf (net like). Thus after division, they become seven hundred (in number)[8].

In modern anatomy, vessels are of 4 types - these are arteries, veins, capillaries and lymph vessels. These vessels are either going away from heart or coming towards heart i.e. branches of arteries increase in number from root to the periphery and veins and lymph vessels decrease in number towards heart. According to this science, from the centre to the periphery, the arteries increase in number by repeated bifurcation and by sending out side branches, in both the systemic and the pulmonary circulation[10].

By observing this scenario of description regarding vessels and *Sira* with modern and *Ayurvedic* perspective, one can say that the ramifications of *Sira* are like venations in a leaf which can be structurally correlated with the distribution of branches of vessels.

C) Types of *Sira* and vessels:

While going through the details regarding types of *Sira* and vessels, it is observed that the colour of *Aruna, Neela, Gauri* and *Rohini Sira*[11]matches with the colour of Capillaries, Veins, Lymph vessels and Arteries respectively[12,13,14]as -

a) 4 types of *Sira*[21]**:** 1. *Aruna* -*Vatavahi*- Blakish red in colour

2. *Neela –Pittavahi* – Blue in colour
3. *Gauri –Kaphavahi* -White or colourless
4. *Rohini –Raktavahi*- Red in colour

b) 4 types of vessels**:** 1**.** Capillaries - Blackish red in colour

2. Veins - Blue in colour

3. Lymph vessels -White or colourless

4. Arteries -Red in colour.

The conclusion of one of the previous studies by Dr. M. S. Dhotre[15] is supportive to above consideration about types of *Sira* and vessels. (Types of *Sira i.e. Aruna, Neela, Gauri* and *Rohini* are to be considered as capillaries, veins, lymph vessels and arteries respectively.)

2. Interpretation of *Vedhya Sira:*

In *Sushruta Samhita,* exact numbers of *Avedhya Sira* are given with their name and site. But while explaining *Siravedha,* specific name and number of *Vedhya Sira* is not mentioned. However, only sites of *Siravedha* are stated. Though the sites of *Siravedha* are mentioned in *Samhita,* the interpretation about underlying structure of these sites is not available in any texts and literary research related to *Vedhya Sira*. So we tried to interpret underlying structure for *Vedhya Sira* through this study for clarity of the concept.

A) On the basis of *Swabhav* of *Sira***:**

In the 8th chapter of *Sharirsthan, Sushruta* described about *Swabhav* of *Sira* that nobody is trained in puncturing *Sira* as they are unsteady i.e. change their position like fish. Hence has to be punctured skillfully.[16]

Feature of *Vedhya Sira* is *Matsyavat* means slippery in nature. As we observe practically, superficial veins where deep fascia is absent are also slippery e.g. dorsum of hand and foot. So *Vedhya Sira* has been considered as superficial veins.

B) On the basis of procedure for *Siravedha*

Sushruta told that *Sira* must be visible before *Vedhan* and to make them visible should be tied with cloth, leather, inner bark of trees, cripper, slender branch or any other material.[17]

In modern treatment tourniquet is applied to make superficial veins prominent[18].

From this context also, it is clear that superficial veins should be considered for *Siravedha vidhi*.

With these aforesaid two references - A. *Swabhav* of *Sira* and B. Procedure of *Siravedha,* it is clear that only superficial veins can be considered for *Siravedha*.

3. Interpretation of *Avedhya Sira:*

While *Siravedha*, *Sushruta* might have observed that some specific structures punctured cause deformity or death. Such structures were categorized under *Avedhya Sira*. In this context *Sushruta* have given more importance to the *Avedhya Sira* than the *Vedhya Sira*. So *Sushruta* might have given exact number of *Avedhya Sira* with its name and site.

Avedhya Sira means the vessels which not to punctured or cut, because after puncturing these vessels it may lead to deformity or death. Some of the causes of deformity or death are -

- The pressure in arteries is more than venous pressure[19]. After puncturing artery there is risk of heavy, profuse bleeding which may lead to deformity or death.
- Nutrition of the body is carried out by arterial supply. If artery is damaged then the part which is supplied will not nourished well and deformity may occur[20].
- When terminal part of some specific veins (great saphenous and cephalic vein) having many tributaries and larger veins are punctured, profuse bleeding occurs which may lead to either deformity or death.

Thus we have considered *Avedhya Sira* as Arteries, larger Veins (e.g. Femoral vein and axillary vein) and terminal part of some specific veins (great saphenous and cephalic vein) having many tributaries.

This above consideration is also supported by one of the previous studies of Dr. D.S. Shelake.[21] He considered arteries (femoral, Axillary and Brachial arteries), larger veins (femoral, Axillary veins) as *Avedhya Sira* but there is difference in opinion about consideration of great saphenous and cephalic vein as *Avedhya Sira*. Here, terminal part of these veins considered as *Avedhya Sira* where as entire veins are considered as *Avedhya Sira* in previous study.

Apart from above scenario *Avedhya Sira* are structures which are nearer to the surface body wall and not to the inner side of the body i.e. in the abdominal cavity or in the thoracic cavity.

In inner side of body inferior vena cava and thoracic / abdominal aorta are the two large vessels present in the body cavity and injury to these structures leads to death. But the sites of *Avedhya Sira* does not correlate with these vessels. So it proves that *Avedhya Sira* are not deep structures.

So here we can correlate *Avedhya Sira* with structures which are nearer to the body wall not to the inner side of the body.

While studying sites of *Vedhya* and *Avedhya Sira* it is noted that, the few sites of *Siravedha* are sites of *Avedhya Sira* or near to the site of *Avedhya Sira*. e.g. *Apang* is site of *Siravedh*a[22] and also a site of *Avedhya Sira*.[23]

In modern anatomy the blood supply of any specific site is by artery accompanying vein. The damage to artery is more dangerous than the vein. Thus at a common site of *Vedhya* and *Avedhya Sira*, we have to consider vein as *Vedhya* and artery as *Avedhya Sira*.

4. <u>Role of *Marma sthan* in confirmation of sites of *Vedhya* and *Avedhya Sira:*</u>

Sushruta explained certain sites of *Siravedha* in accordance with *Marma sthan.* E.g In *Padadaha, Padharsha Siravedha* should be done two Angula above *Kshipra Marma*[22]. Here we can understand that the site for *Siravedha* can be confirmed with the location of *Marma sthan.*

Most of the sites of *Avedhya Sira* are at *Marma sthan.* It is because at the site of marma, there is *sthan* of *Prana*[24]. If get inflicted with trauma *(Shalyakarma),* the person definitely will show symptoms of *Marmaghat* including death.

Most of the names of *Avedhya Sira* are as per the names of *Marma* present at particular site. E.g. *Lohitaksha, Urvi, Neela, Manya, Bruhati* etc. [25]

Here, we have considered *sthan* of various *Marma* for confirmation of exact site of *Vedhya* and *Avedhya Sira*.

II) <u>DISCUSSION ON THE BASIS OF SURVEY STUDY:</u>

A preliminary discussion with various Ayurved practitioners doing *Siravedha* was conducted to verify the feasibility of topic selected.

During discussion with these *Vaidyas* we tried to draw out the anatomical structure of *Vedhya* and *Avedhya Sira*, but none of them were able to provide the exact anatomical structure at the site of *Siravedha*.

As per their suggestions, Survey of *Siravedha* practicing *Vaidyas* all over India has to be adopted to explore contemporary relevance of *Siravedha* method described by *Sushruta* and to derive comprehensive data about identification of exact anatomical structure for *Vedhya* and *Avedhya Sira*.

About observations from Questionnaire:

By communicating with these 100 *Vaidyas* we tried to categorise (identify) these *Vaidyas* in different schools of thoughts of *Siravedha* practice with the help of above study.

- From the survey study, it is observed that all *Siravedha* practicing *Vaidyas* were puncturing superficial veins for *Siravedha* but not mentioned the name of that superficial vein. Without knowing the name of *Vedhya Sira*, *Siravedha* can be conducted but information about name and site of *Vedhya Sira* is essential as that confirmation may help to utilize all sites of *Siravedha* stated by *Sushruta* in various diseases. So in this study, we tried to find out exact anatomical structure for *Vedhya Sira*. It is also noted that *Siravedha* practicing *Vaidyas* did not mention any information about *Avedhya Sira*. But one should have knowledge of *Avedhya Sira*, as lack of knowledge regarding *Avedhya Sira* may result in complications if punctured. So in this study, we also tried to find out exact anatomical structure for *Avedhya Sira*.
- *Siravedha* was conducted commonly at the sites on extremities and very less at the other sites mentioned by *Sushruta*. It may be due to fact that the *Sira* at extremities are easily visible and prominent, thus it becomes ease to conduct *Siravedha* and they prefer *Jalauka* instead of *Siravedha* at other sites like *Adhojivha, Apang, Vrushan*.
- The principle of *Siravedha* i.e. *Siravedha* should be carried out in the diseases resulting out of *Rakta dushti* is unchanged but timely the method of *Siravedha* practice is changed. Thus different schools of *Siravedha* practice came in existence with somewhat modified or totally different approach of their own way than that of *Sushruta* or *Vagbhata*.
- Followers of any specific school are doing *Siravedha* by utilising the direct knowledge from that *Vaidya* or some from their text or some indirectly i.e. from the *Vaidyas* following a particular school of *Siravedha*.

III) DISCUSSION ON THE BASIS OF RETROSPECTIVE STUDY OF DOCUMENTED POST MORTEM CASE REPORT:

The purpose of including retrospective study of documented post-mortem case report was to identify *Avedhya Sira* and that has been studied by finding cause of death due to injury to single artery or Vein i.e. *Avedhya Sira*.

After study of 306 post mortem cases, it was observed that no single structure damage (any artery or vein i.e. *Avedhya Sira*) lead to death. It is due to the fact that in accidents and injuries caused by weapons; multiple structures are damaged leading to excessive bleeding from different sites and which eventually leads to death.

- The opinion of H.O.D. of F.M.T of Sasoon hospital was supportive to above statement i.e., *"it is observed that a damage of a particular structure leads to death was not found, as cause of death is because of multiple injuries and/or damaged multiple structures."*

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SUMMARY

Introduction:

Siravedha described by *Sushruta*, is one of the important modalities in various diseases. *Sushruta* has mentioned specific sites for *Siravedha* and sites for *Avedhya Sira. Vedhan* of *Avedhya Sira* leads to either grievous deformity or death.

For the desired outcome in treatment and to avoid complications due to puncture of *Avedhya Sira*, complete knowledge of *Siravedha vidhi* is essential. So it becomes invariably essential to find out the anatomical structures to which one can label as *Vedhya* and *Avedhya Sira.*

Hence, the frame of the thesis work entitled "Comparative study of *Vedhya* and *Avedhya Sira* described by *Sushruta* versus *Siravedha* methods of different schools of thoughts in vogue." is designed with following chapters viz.

- Aim and objectives
- Literature review
- Methodology – Observations
- Discussion
- Summary and Conclusion

Aim:

1. To confirm anatomical structure of *Vedhya* and *Avedhya Sira* and to understand their concept in present era.

Objectives:

1. To correlate *Sira* with modern anatomical structure
2. To differentiate the *Vedhya* and *Avedhya Sira*
3. To explore whether, the *Siravedha* method described by *Sushruta* and *Siravedha* method of different schools in vogue are same or not.

Literature review: The *Ayurved* literature review consists of number and types of *Sira*, functions of *Sira*, importance of *Siravedha* and sites of *Vedhya* and *Avedhya Sira.* The Modern literature review consists of details of types of vessels, structure and functions of vessels.

Methods: The following plan of work has been adopted to confirm anatomical structure for *Vedhya* and *Avedhya Sira*.

A. Conceptual study

B. Survey study

C. Retrospective study of Documented Post mortem Case report

A) <u>Conceptual Study</u>:

1. Comparison of *Sira* with Vessels: Comparison of *Sira* with vessels is carried out on the basis of their origin, distribution, functions and types.

2. Theoretical Interpretation of *Vedhya Sira*: The *Vedhya Sira* are explained with following points for each *Vyadhi,* in which *Siravedha* is indicated.

i) Sutra in Devnagari

ii) Translation in English

iii) Site with justification

iv) Structures at considered site

v) Interpretation

3) Theoretical interpretation of *Avedhya Sira*: The *Avedhya Sira* are explained in the same manner like that of *Vedhya Sira*.

B) <u>Survey study</u>: Survey was carried out with the questionnaires.

1) <u>Questionnaire-A - For identification of *Siravedha* practicing *Vaidyas*.</u>

2) <u>Questionnaire-B - For survey of *Siravedha* Practicing *Vaidyas*</u>

Questionnaire-B (B-1 and B-2) was sent to 155 *Vaidyas* all over the India who are practicing *Siravedha*. Out of 155 *Vaidyas,* we received Questionnaire feedback from 100 *Siravedha* practicing *Vaidyas*.

C) <u>Retrospective Study of Documented Post Mortem Case Report:</u>

Retrospective study has been carried out of 306 post mortem cases regarding cause of death because of single structure injury, multiple injuries and/or head injury with the intention to find out whether death is due to injury to *Avedhya Sira* or not.

<u>Observations:</u>

A) Observations based on Conceptual Study: - *Sira* and vessels are having similar function as nourishment of body and the colour of types of *Sira* matches with colour of types of vessels. So *Sira* are the vessels.

The *Sushrutokta* sites of *Siravedha* are superficial veins and tributaries of veins which are not superficial at that particular site. E.g. In *Grudhrasi*, site of *Siravedha* is 4 *Angula above or below Janu which is g*reat saphenous vein (4 *angula* either above or below the Knee joint according to modern.)

The *Avedhya Sira* are terminal part of some specific superficial veins having many tributaries, arteries and larger veins present nearer to body wall. E.g. 1. *Jaladhara* 1 in each *Shakha* is terminal part (near saphenous opening) of Great saphenous vein. 2. *Medhropari Romraji Ubhayata Sira* are four, which are Inferior epigastric artery-2 and inferior epigastric vein-2

B) Observations based on Survey Study:

a) None of the *Vaidyas* are doing *Siravedha* at all sites. The commonly used sites for *Siravedha* are nearby *Gulpha, Janu and Kurpar*

b) 1-2 sites are used by maximum *Vaidyas* i.e.71% and few *Vaidyas* are doing *Siravedha* at more than 10 sites.

c) Most of the *Vaidyas* (60-70%) are doing *Siravedha* in *Grudhrasi, Padadaha, Padaharsha Vyadhis* whereas only 1% is doing *Siravedha* in *Tritiyak Jwar, Chaturthak Jwar, Jivha and Danta roga*.

d) All these *Vaidyas* from different schools are using superficial veins for *Siravedha* but not knowing the name of that particular superficial vein.

e) There is no any information available regarding the instance of complications due to puncture of *Avedhya Sira* in the practice from this survey feedback.

f) Observation table - No. of *Vaidyas* belonging to 5 different schools of thoughts of *Siravedha* practice and details regarding their *Siravedha* methods found through survey study.

Name of school of thoughts	**No. of *Vaidyas* under it**	**Basic Reference of *Siravedha***	**Consideration of *Vedhya Siras* as------**	**Specific name of superficial Vein**	**Instrument Utilized**	***Siravedha* performed at no. of sites**	**Blood quantity Unit**
Vd. Gogate	36	*Sushruta*	Superficial Veins	Not specified	Scalp van. No. 18/20 Needle no. 26	15-22	Automatic stoppage of blood
Vd. Joshi	21	*Sushruta*	Superficial Veins	Not specified	Needle No.18	15-20	Automatic stoppage of blood
Vd. Acharya	6	*Vagbhat*	Superficial Veins	Not specified	Scalp van. No. 20/21	3-6	50-100ml
Vd. Rajguru	4	*Sushruta/ Vagbhat*	Superficial Veins	Not specified	Needle 1 inch	3-5	20-30ml
***Vaidyas* performing with their own method**	33	*Sushruta/ Vagbhat*	Superficial Veins	Not specified	Scalp van. No. 18/20 various size of Needles	1-7	Not specified
	100						

C) Observations based on Retrospective Study of Documented Post Mortem Case Report:

A single structure damage (any artery or vein i.e. *Avedhya Sira*) leading to death was not found; rather the causes of death were because of multiple injuries and/or damaged multiple structures.

Discussion:

The probable confirmation of anatomical structure for *Vedhya* and *Avedhya Sira* has been discussed on the basis of interpretation of observations drawn from above study.

Conclusions:

Conclusions based on Conceptual study

1) *Sira* are the vessels and types of *Sira* i.e. *Aruna, Neela, Gauri* and *Rohini* are to be considered as Capillaries, Veins, Lymph vessels and Arteries respectively.
2) The *Vedhya Sira* are the superficial veins of the particular sites.
3) The *Avedhya Sira* are arteries, larger veins and terminal parts of some specific superficial veins having many tributaries.

Conclusions based on Survey study

1) None of the *Vaidyas* are utilizing *Siravedha* method described by *Sushruta*'as it is' in their practice. The Commonly used sites are nearby *Gulf, Janu* and *Kurpar*.
2) No *Vaidyas* are utilizing all sites for *Siravedha* described by *Sushruta.*
3) The underlying structure for sites of *Vedhya Sira* is considered as superficial vein of that particular site.

CONCLUSIONS

- Conclusions based on Conceptual study

  1) *Sira* are the vessels

  2) Types of *Sira* i.e. *Aruna, Neela, Gauri* and *Rohini* are to be considered as Capillaries, Veins, Lymph vessels and Arteries respectively.

  3) The *Vedhya Sira* are the superficial veins of the particular sites.

  4) The *Avedhya Sira* are Arteries, Larger veins and the Terminal parts of some specific superficial veins having many tributaries.

- Conclusions based on Survey study

  1) None of the *Vaidyas* are utilizing *Siravedha* method described by *Sushruta*'as it is' in their practice.
  2) No *Vaidyas* are utilizing all sites for *Siravedha* described by *Sushruta*. The Commonly used sites are nearby *Gulf, Janu* and *Kurpar*.
  3) The underlying structure for sites of *Vedhya Sira* is considered as superficial vein of that particular site.

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ANNEXURE I

ABBREVIATIONS

अ.सं.सू.- Ashtanga Sangraha Sutrasthan

अ.सं. शा.- Ashtanga Sangraha Sharirsthan

अ.ह्र.शा.- Ashtanga Hridaya Sharirsthan

सू. सू.- Sushruta Samhita Sutrasthan

सु.शा.- Sushruta Sharirsthan

सू. चि. -Sushruta Chikistasthan

च.सू.- Charaka Sutrasthan

Other

Dr. - Doctor

Prof. - Professor

i.e. -That is

Dept. -Department

Pg. – Page

Pg. No. - Page Number

In Tables

S. No. /S.N. - Serial Number

Symbol used

% - Percentage

ANNEXURE II

Questionnaire-A - For Identification of *Siravedha* Practicing *Vaidyas*

i) Do you know *Siravedha* Practicing *Vaidyas*? Yes /No

ii) If yes - Give name, address and contact number.

ANNEXURE III

Questionnaire- B-1 for Confirmatory Sites of *Vedhya Sira*

Sr. No.	Vyadhi	*Granthokta* site of *Siravedha*	*Granthokta* site used? (Mention underlying structure)		If no, which site you prefer? (Mention underlying structure)	Methods				Blood quantity (ml/drops)	Relief		
			Yes	No		Instruments used	No. of pricks at site.	Number of *Siravedha* required	Time interval between *Siravedha*		Relief within (specify period)	Recurrence yes/no	If yes, Duration
	ADHOSHAKHA												
1.	*Padadaha, padharsha, chippa, visarpra, vatkantak, vicharchika, and padadari etc.*	*2 Angula* above *Kshipra Marma* by *Vrihimukha.*											
2.	*Shlipad*	*4 Angula* above or below *Gulpha*											
3.	*Krostukashirsha, Khanja, Pangu & Vatvedana*	*4 Angula* above *Gulpha.*											
4.	*Apachi*	*2Angula* below *Indrabasti*											
5.	*Grudhrasi*	*4 Angula* above or below *Janu.*											
6.	*Galaganda*	*Sira of Urumula* (root of Thigh)											
	BAHU												
1.	*Pliha Vriddhi*	Inner side of *Karpura Sandhi (*at the centre of *vaama-Bahu* OR at middle of left *Kanistika & anamika*											
2.	*Yakrutdakhya*	Inner side of the *Karpura Sandhi* (at the centre of *Dakshina-Bahu* OR at middle of right *Kanistika & anamika*											
3.	*Kasa – Shvasa*	Inner side of the *Karpura Sandhi (at the* centre of *Dakshina-Bahu* OR at middle of right *Kanistika & anamika*											
4.	*Visvachi*	*4 Angula Pradesh* above or below *kurpar Sandhi*											

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Sr. No.	*Vyadhi*	*Granthokta site of Siravedha*	*Granthokta* site used? (Mention underlying structure)		If no, which site you prefer? (Mention underlying structure)	Methods				Blood quantity (ml/drops)	Relief		
			Yes	No		Instruments used	No. of pricks at site.	Number of *Siravedha* required	Time interval between *Siravedha*		Relief within (specify period)	Recurrence yes/no	If yes Duration
	SHRONI - PRISHTHA - MADHYAKAYA = TRUNK												
1.	*Shulayukta Pravahika*	*2 Angula* nearby *Shroni*											
2.	*Parivartika, Updamsha, Shukadosa, dieses of Shukra*	Middle of *Shishna*											
3.	*Mutravriddhi*	*Parshava* of *Vrishna*											
4.	*Jalodar*	Left to *sevani* located *4 Angula* below umbilicus											
5.	*Antar-Vidradhi & Parshva-Shula*	At centre of *Kaksha & Stana* at left *Vaama-Parshva*											
6.	*Bahushosha & Avabahuka*	In-between *2 Ansa*											
7.	*Tritiyaka Jvara*	*Madhya Sira* of *Trika Sandhi*											
8.	*Chaturthaka Jvara*	*Sira* of *any parshwa* located below *skandha sandhi*											
	URDHWA JATRUGAT												
1.	*Apasmara*	Middle of *Hanusandhi*											
2.	*Unmada*	*Sira* of *Shankha & Keshanta Shandhi.* Also *Sira* of *ura, Apanga,Lalat*											
3.	*Jivha & Dantaroga*	*Sira* below *Jivha*											
4.	*Talu Roga*	*Talu*											
5.	*Karna Shula & Karna Roga*	Above and around the *karna.*											
6.	*Nasa Roga*	*Agrabhaga* of *Nasa*											
7.	*Timira, Akshipaka, etc.*	Nearby *Nasa, at apang, or lalat*											
8.	*Shiroroga, Adhimantha*	Nearby *Nasa,* at *apang,or lalat*											

ANNEXURE III

Questionnaire-B-2 for Confirmatory Sites of *Avedhya Sira*						
	Sushrutokta* description regarding *Avedhya Sira	**Name of *Avedhya Sira***	**Number**		**Total**	**Remark regarding underlying structure for *Avedhya Sira*(Modern)**
			Rt	**Lt**		
	तासां जालधरा त्वेका, तिस्रश्चाभ्यन्तराः - तत्रोर्वीसंज्ञे द्वे, लोहिताक्षसंज्ञा चैका, तास्त्वव्यध्याः; एतेनेतरसक्थि बाहू च व्याख्यातौ; एवमशस्त्रकृत्याः षोडश शाखासु (One hundred *Sira* are present in one leg; of them, one *jaladhara* and three internal ones-two *urvi* and one *lohitaksha*- should not be punctured.)	*Jaladhara* *Urvi* *Lohitaksha*	4 4	4 4	16	
	द्वात्रिंशच्छ्रोण्यां, तासामष्टावशस्त्रकृत्याः - द्वे द्वे विटपयोः, कटीकतरुणयोश्च, (Thirty two are in *shroni Pradesh,* of them, eight should be avoided in *siravedha*. At the *vitap* two in each side and similarly *katiktarun* (two in each side)		2 2	2 2	8	
	अष्टावष्टावेकैकस्मिन् पार्श्वे, तासामेकैकामूर्ध्वगां परिहरेत्, पार्श्वसन्धिगते च द्वे (Eight are in each *parshwa,* out of them one going upwards on each side and two in *parshwasandhi* should be avoided)		1 1	1 1	4	
	चतस्रो विंशतिश्च पृष्ठे पृष्ठवंशमुभयतः, तासामूर्ध्वगामिन्यौ द्वे द्वे परिहरेद्बृहतीसिर (Twenty four *siras* are in back on both side of the *Prushtvansha*) vertebral coloum, of them two *bruhati siras* going upwards on each side should be avoided.)		1	1	2	
	तावत्य एवोदरे, तासां मेढ्रोपरि रोमराजीमुभयतो द्वे द्वे परिहरेत् (Twenty four *siras* in abdomen; of them, two on both sides of the hair line(*romraji)* above penis (*medhropari ubhaytaha)* should be avoided**.)**		2	2	4	
	चत्वारिंशद्वक्षसि, तासां चतुर्दशाशस्त्रकृत्याः - हृदये द्वे, द्वे द्वे स्तनमूले, स्तनरोहितापलापस्तम्भेषूभयतोऽष्टौ, एवं द्वात्रिंशदशस्त्रकृत्याः पृष्ठेदरोरःसु भवन्ति । (Fourty *siras* are in thorax, of them fourteen are avoidable- two in *hridaya, stanmula* two each, on the sides of *stanrohita , apalap* and *apastambha* eight *siras*. Thus fourteen *Avedhya siras* present in *vaksha* region.)		1 2 4	1 2 4	14	
	चतुःषष्टं सिराशतं जत्रुण ऊर्ध्वं भवति, तत्र षट्पञ्चाशच्छिरोधरायां, तासामष्टौ चतस्रश्च मर्मसंज्ञाः परिहरेत्, द्वे कृकाटिकयोः, द्वे विधुरयोः, एवं ग्रीवायां षोडशाव्यध्याः (One hundred and sixty four *siras* are in head and neck region; of them fifty six are in neck, out of them twelve *marmas* (Eight- *matruka* and four – two *nila* and two *manya*), apart from two each in *krakatika* and *vidhura*.- thus sixteen in neck are *Avedhya siras*.)		1 1 4 1 1	1 1 4 1 1	16	
	हन्वोरुभयतोऽष्टावष्टौ, तासां तु सन्धिधमन्यौ द्वे द्वे परिहरेत् (On each side of jaw eigth *siras* present of which *sandhidhamanis* two on each side of (Temporomandibular joint) are *avedhya siras.*)		2	2	4	
	षट्त्रिंशज्जिह्वायां, तासामधः षोडशाशस्त्रकृत्याः, रसवहे द्वे वाग्वहे च द्वे (Thirty six are in tongue of which sixteen *siras* are situated below; of them, two *rasavahe* and two *vaghvahe* are *Avedhya siras.*)	*Rasavaha* *Vagvaha*	2	2	4	
	द्विर्द्वादश नासायां, तासामौपनासिक्यश्चतस्रः परिहरेत्, तासामेव च तालुन्येकां मृदावुद्देशे (Twenty four *siras* are in nose, of them four situated nearby *nasa* and also one in palate's soft portion should be avoided.)		4 1		5	
	अष्टत्रिंशदुभयोर्नेत्रयोः तासामेकैकामपाङ्ग्योः परिहरेत्, (In both eyes are thirty eight *siras*; of them, one in each *apanga* should be avoided.)		1	1	2	
	कर्णयोर्दश, तासां शब्दवाहिनीमेकैकां परिहरेत् (Ten are in ears of which the *shabdavahi sira* one in each side should be avoided.)	*Shabdavahi*	1	1	2	
	तासां केशान्तानुगताश्चतस्रः, आवर्तयोरेकैका, स्थपन्यां चैका परिहर्तव्या (In *Lalat*, supplying nose and eyes are sixty *siras*; of them, four are of *keshant*, one each in two *awartas* and one in *stapani* should be avoided.)		2 1 1	2 1	7	
	शङ्ख्योर्दश, तासां शङ्खसन्धिगतामेकैकां परिहरेत् (Ten *siras* are in *shankha Pradesh*: of them one each in *shankha sandhi* (Temporomandibular joint) should be avoided.)		1	1	2	
	द्वादश मूर्ध्नि, तासामुत्क्षेपयोर्द्वे परिहरेत्, सीमन्तेष्वेकैकाम् एकामधिपतावितिं एवमशस्त्रकृत्याः पञ्चाशज्जत्रुण ऊर्ध्वमिति ।।२५।। (Twelve *siras* are in *shir*, of them two in utkseps, one each in *simantas* and one in *adhipati* should be avoided.		1 5 1	1	8	

ANNEXURE III

Guidelines to fill Questionnaire- B-2 for confirmation of sites of *Avedhya Sira*:-

1) As you are well known *Ayurved* practioners, you are aware that *Sushruta* has portrayed concept of *Avedhya Sira* in 7th chapter of *Sharir sthana.*

2) Hence, kindly give the following information as detail as possible because it will definitely create conceptual awareness in *Ayurved* learners, scholars of future.

   Whether you utilize this knowledge to avoid *Avedhya Sira* in your practice of *Siravedha*?

   Yes/ No.

   If answer is yes, please, give the following information.

   Which base or parameters you have utilized or developed to identify the *Avedhya Sira* (Modern structure)?

   1.

   2.

   3.

   How many sites you applied these parameters to identify *Avedhya Sira*?

   Out of these sites, at how many sites you have succeeded to identify *Avedhya Sira*?

Note be: Give details of structure you have identified at those sites according to modern and fill the same information in format provided to you (which is attached along with this sheet)

Remark of *Vaidya*:-

Name of *Vaidya*:-

Address:-

Contact No:-

e.mail ID- **Seal**

Regi. No:- **Signature**

1) **Experience as a Vaidya (In Years):-**
2) **Experience in *Siravedha*(In Years):-**
3) **Cases of *Siravedha* carried so far:-**
4) **Name the tradition which you follow for *Siravedha* method:-**.

(If require, please attach additional paper or separate sheet.)