The study of sharirkriyatmak importance of mahasrotas as moolsthana of pranvaha srotas with special reference to tamak shwas

In the Subject of Kriya Sharir

Submitted by

Dr. Shruti D. Phatak

Under Guidance of

Prof. Dr. Kalpana Sathe

Faculty of Ayurved

Tilak Maharashtra Vidyapeeth , Pune-37

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CERTIFICATE

This is to certify that the thesis entitled ' **The Study of Sharirkriyatmaka importance of Mahasrotas as Moolsthana of 'Pranavaha Srotas ' with special reference to ' Tamak Shwasa '** which is being submitted herewith for the degree of Vidyavachaspati (Ph.D.) in Kriya Sharir of Tilak Maharashtra Vidyapeeth , Pune , is the result of original research work completed by Dr. Shruti D. Phatak under my supervision and guidance . The best of my knowledge and belief the work incorporated in this thesis work has not formed the basis for the award of any degree or similar title of this or any other University or examining body upon her .

Place : Pune

Date : 24/11/2017

Research Guide

Research Guide
Dept. of Kriya Sharir
MAM's SSAM's DGIPGS & RIA
Hadapsar, Pune-28.

CERTIFICATION

To,

The Controller of Examination ,

TMV , Pune – 37 .

Subject : Submission of Thesis .

I undersigned enrolled for Ph.D. in Ayurved faculty in **year 2012 , PRN NO. 05611004575** .I have finished my thesis worktitled 'The Study of Sharirkriyatmaka importance ofMahasrotas as Moolsthana of 'PranavahaSrotas ' with special reference to 'TamakShwasa' under guidance of Prof.Dr.KalpanaSathe .

Herewith I am submitting the thesis as per instructions given by University .

I request to your good office to accept my thesis work for approval .

Please accept and do the needful .

Thanking you ,

Yours faithfully ,

Dr.Shruti D. Phatak ,

PRN NO. 05611004575


ओम् नमो

शास्त्रं हि एवं विधम् अमलं इव

आदित्यस्तमो विधूय प्रकाशयति सर्वम् □चरक संहिता

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INTRODUCTION

Sharir Kriya comprises basic concepts of *Ayurved* like *Tridosh* , *Saptdhatu* , *Mala* , *Panchmahabhut* or *Srotas* concept . *Sharir* or Human living body is considered as , well synchronised , co-ordinated '*Srotas*' or channels within the body . In *Charak Samhita* , body is said to be '*Srotomaya*' or consisting innumerable '*Srotas*' , may be gross or subtle [1] .

On the other hand Modern Science identifies human body as a synchronisation of cells , tissues , organs and systems . Different systems consisting different tissues and organs attributed to perform certain physiologic function . *Ayurvediya* perception of ' *Srotas* ' is different than the 'System' understood by Modern Science . '*Srotas*' are pathways or channels within the human body concerned with some physiological metabolic activities . These pathways might not be anatomically related every time but might have some physio-pathological axis between two morphologically distinct and distant organs .

In *Ayurved* though '*Srotas*' are considered innumerable , certain fix number of *Srotas* are considered by two prime *Acharyas* i.e. Charak and *Sushrut* .

Achraya Charak has considered 13 number of *Srotas* and *Acharya Sushrut* 11 [2] . Both have broadly described *Prana* , *Anna* , *Udaka* , *Srotas* of *Saptadhatu* and also *Srotas* of *Mala* . These *Srotas* are mainly meant for metabolic processes regarding nutrition of the *Dhatu* [3] , elimination of waste products and may be having some metabolic controlling axis within them . Both *Acharyas* describe *Moolsthana* or the 'Vital Site Of Origin' of all the *Srotas* , though in some *Srotas* they differ in considering their *Moolsthana* .

This apparent difference in opinion may be because of having their different perspectives being physician and surgeon respectively .

This thesis work mainly concerns with *Pranavaha Srotas* and it's *Moolsthana* . *Achraya Charak* and *Sushrut* both have described their *Moolsthana* of *Pranavaha Srotas* differently . According to *Acharya Charak* , *Hriday* and *Mahasrotas* [4] are *Moolsthana* of *Pranavaha Srotas* and by *Acharya Sushrut Hriday* and *Rasavahi Dhamani* [5].

Focus of this thesis work is ' *Mahasrotas* ' as ' *Moolsthana* ' of *Pranavaha Srotas* considered by *Acharya Charak* . *Mahasrotas* is broadly interpreted as GI tract because area between *Nabhi* (umbilicus) and *Stana* (breast) is considered as *Mahasrotas* [6] . *Pranavaha Srotas* is interpreted as Respiratory system as *Prana* (vital substance to body i.e. *Ambarpiyush*) is taken up by the body through this *Srotas* .

This thesis work is about finding out the rationale behind considering '*Mahasrotas*' as '*Moolsthana*' of '*Pranavaha Srotas*' by *Acharya Charak* with context to *Tamakshwasa* which is most prevalent disease of the *Pranavaha Srotas* .

Previous works on this topic deal with mainly the interpretations of *Moolsthana* of *Pranavaha Srotas* other than *Mahasrotas* and those are mainly reviews . There was a possibility to explore any physio-pathological pathway between these anatomically distinct organs or systems (i.e. *Pranavaha Srotas* and *Mahasrotas*) as *Mahasrotas* has been considered as *Moolsthana* of *Pranavaha Srotas* .

Some references indicated that Serotonin , a neurotransmitter secreted by entero-chromaffin cells throughout the gut , taken up mainly by platelets in blood , and has immunomodulatory effect on inflammatory processes occur in Respiratory system on exposure to triggering factor to bring about bronchial hyper-responsiveness i.e. Asthma / *Tamakshwasa* [7] [8] .

These references initiated to redefine the role of *Mahasrotas* as *Moolsthana* of *Pranavaha Srotas* and reinterpret it in new perspective . In this study , attempt has been made to co-relate Serum Serotonin levels in *Tamakashwasa* patients as it is the most prevalent disease of *Pranavaha Srotas* .

For framing Hypothesis two groups were proposed i.e. Group A same set of patients as Group B in *Avegavastha* & Group B - 100 *Tamakashwasa* patients in *Vegavastha* . Total 88 patients completed the trial as per protocol . So the observations and results are based on the data of 88 patients only from Group A and B.

Ayurvediya Concepts are more clinically relevant and applicable and directing in process of diagnosing and giving insights in pathophysiological events .

This work is a humble attempt to explore the concept itself and its applicability in finding physio -pathological pathway and subsequently possibility in deciding preventive and treatment guidelines .

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LITERATURE REVIEW

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Philosophical Background Of Subject

Basic Philosophy of *Ayurved*

Person having balanced or equilibrial condition of *Dosha* (Bio energies) , *Dhatu* (body tissues) , *Mala* (waste products) , *Agni* (metabolic fire) and blissful & balanced state of Soul , Senses and Mind is called as *Swastha* or healthy person .[1]

To create or maintain equilibrium within *Tridosh* , *Saptadhatu* , *Mala* and also Soul , Senses and Mind is the goal of *Ayurved* .[2]

In order to achieve this goal physician has to understand perfectly the human body by it's structure and function which is collectively called as '*Sharirvichay*' .[3]

Ayurved understands human body with its structural visible part and also it's abstract or metaphysical counterpart . For this , *Ayurved* also adopts the philosophical elements like Soul , Mind , Senses in the human being . Being the reason , in *Charak Samhita Sharirsthana* , subjects like *Atma , Chetana , Mana , Indriya , Buddhi , Ahankar* are discussed quite in length and depth and not merely the anatomical descriptions .

Acharya Charak has also discussed the ultimate reasons of misery and the ways for emancipation or liberation i.e. *Moksha* , in the same section of treatise .

Though liberation could be the ultimate aim of human existence , getting rid of bodily miseries is the prime focus of any physician .

Ayurved accepts body and mind as two seats of diseases .[4] Disease free body and balanced and well synchronised *Buddhi* (intellect) , *Indriya* (sense organs) and *Artha* (sense objects) creates *Sukha* or bliss or feeling of wellbeing , which is the goal of *Ayurved* .

Panchamahabhut siddhant , *Shad dhatwatmak Purush siddhant* are basic tenets of *Ayurved* . *Panch mahabhut* and *Atma* or *Chetana* (life force) are principal dogmas of human existence .[5] From which *Panchmahabhutas* form the structural part of the body (*sharir*) . Only in presence of *Atma* or *Chetana* it becomes lively .

Sharirkriya deals with basic principles of *Ayurved* involving basic understanding of biological activities in body in terms of *Dosha* (Biological humours governing all bodily activities), *Dhatu* (7 types of tissues performing different functions in body), *Mala* (metabolic waste products).

Srotas , their *Moolsthana* are the concept of *Shrirkriya* i.e. functioning of the body .

Modern system of Biology recognises body unit in terms of cell ,tissue , organ ,system ; where as *Ayurved* understands body in terms of *Dosha, Dhatu* and *Mala* . In *Ayurved*

understanding of body is mainly through functional units irrespective of the structural aspect .

If cell is a structural and functional unit or *Dhatuparamanu* of a living body one can classify cellular functions in terms of *Dosha* , *Dhatu* and *Mala* .

Eg. Cellular transport , signalling system ,messenger system , all subtle movements required for cellular functions - represents function of *Vata*

All enzymatic actions , transformation of nutrients into biological energy form , catabolic activities etc. - represents *Pitta* .

All anabolic activities , protein synthesis , formation of new biological molecules , multiplication etc. - representing *Kapha*

Although all functions go in synchronisation and complement each other . Not a single function is possible without the other's help .

Ayurved believes that *Tridosh* are driving forces of the living body and *Sapta Dhatus* are functional tissues of the body , through which certain functions are achieved .

Rasa dhatu - fluid balance , electrolyte balance , maintaining and balancing water compartments in the body .

Rakta dhatu - Reticuloendothelial system , haemoglobin metabolism , oxygen supply at tissue level .

Mansa dhatu - covering the bony frame of body to give specific shape to the body , locomotion through it's contractility .

Meda - lubricating every bodily structure keeping them supple from phospholipid cell wall to synovial fluid kept in knee joint or CSF in cranial cavity .

Asthi - form bony frame of body , give all grades of firmness , stability , hardness to body structures from hair ,teeth , nails to bones ,tendons ,fascia etc .

Majja - lubricating core part of *Asthi dhatu* keeping them sturdy , forms nerve tissues , insulate nerves , protect nervous system by uninterrupted energy supply .

Shukra - form male and female gametes , regeneration , giving rise to new human being .

Ayurvedic understanding of *Dhatus* are more by their functional aspects rather than their morphological base .

Certain *Srotas* or channels are considered for smooth functioning of the body . Each *Dhatu* has it's own *Srotas* and each *Srotas* performs different exclusive vital function .[6]

Srotas is nothing but functional channel in the body doing exclusive vital function .

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Concept of *Srotas*

SROTAS

ई ३ं २३३ स्त्रोत इंद्रिये निम्नगारये [illegible]३३ [illegible] [illegible]६२२[illegible]

स्त्रवति [illegible]स्त्रुगतौ [illegible]

स्त्रोतोऽम्बुवेग इन्द्रिये [illegible]मेदिनी [illegible]१७३ क्र ४६[illegible]

१ १ó ११ स्त्रोतोऽम्बुसरणं स्वत[illegible] [illegible]१२४ [illegible]

स्त्रोत इति [illegible]स्त्रवति [illegible]स्त्रु गतौ [illegible]

स्त्रोतोऽम्बुवेग इन्द्रिये [illegible] इति मेदिनी १७३ क्र ४६[illegible]

२ ३ ५ प्रस्त्रवणम् स्त्रु गतौ [illegible] [illegible]१६१ [illegible]

यतो जलं स्त्रवति तस्य स्थानस्य [illegible]

काशी संस्कृतमाला [illegible]पंडितवरश्रीमदमरसिंहविरचित नामलिङ्गानुशासन नाम अमरकोष [illegible][illegible]

चतुर्थ संस्करण [illegible]चौखंबा संस्कृत संस्थान [illegible]वि.सं २०५७

वाराणसी २२१००१ [illegible]भारत .

स्त्रु [illegible]स्त्रोत [illegible]स्त्रवति all these words are concerned with the act of flowing of some fluid. It is very clear from its etymology that स्त्रु [illegible]स्त्रवति means flowing of the fluid from its own site to other.

स्रवणात् स्रोतांसि [illegible]चरक सुत्र ३०क्र १२

स्त्रवणादिति रसादेवेरेव पोष्यस्य स्त्रवणात् [illegible]चरक सुत्र ३०क्र १२ [illegible]च [illegible]पाणि टिका

" *Sru sarati* " means to flow [1] , to exude , to ooze ,to filter , to permeate . By etymology *Srotas* is what with in which something flows or carried . *Srotas* is the functional channel within the living body , concerned with one exclusive vital function . First description of *Srotas* in *Charak Samhita* comes in *Sutrasthana* , 28th chapter regarding the nutrition of the *Dhatus*. *Srotas* are the base of transformation of nutrients in biological elements , being the metabolic centre of that particular *Dhatu* , transport of nutrients and waste products [2]. Later in *Srotoviman adhyaya Acharya Charak* has discussed the concept of *Srotas* elaborately .

"*Srotas*" which is the transport system of the body has many synonyms listed below [3] :

Srotamsi - channels

Siras - veins

Dhamanis - arteries

Rasayanis - lymphatics

Rasavahini - capillaries

Nadis - tubular conduits

Panthanas - passages

Margas - pathways

Sharir chidras - body orifices

Samvrut samvrutani - open ,closed

Sthanas - sites , locus

Ashayas - repertories

Niketas - resorts

The nomenclature mentioned above pertains to both the visible and non visible channels those enable the movement of *Sharir Dhatus* (body elements) . The internal transport system of the body , is represented by *Srotas* , has been given a place of fundamental importance both in state of health and disease . Structural and functional integrity of these *Srotas* is needed in order to maintain normal physiology , likewise impairment in this integrity can lead to pathological states .

Ayurved believes in *Lokpurushanyaya* [4] i.e. concept of Simile between macrocosm and microcosm . According to it all elements in Universe represent in human body . So innumerable *Srotas* are present in body representing infinite elements in the universe .

Regarding the concept of *Srotas* , human body consists multiple and innumerable *Srotas* . All metabolic activities take place in the concerned *Srotas* [5] . Conceptually body has as many *Srotas* as it contains the biochemical entities . *Dhatus* being functional tissues , *Mala* being excretory products and *Prana* , *Anna* and *Udaka* being the vital entities or *Bahyaprana* , have their own *Srotas* or separate functioning channels [6].

Srotas are micro or macro spaces in the body which carry the different biochemical molecules during the process of metabolism .

Characteristics of *Srotas* :

In the words of *Charak Samhita* , *Srotas* can be *Sthula / Sukshma* macro / microscopic , *Vrutta* - round in shape, *Dirgha* - elongated and *Pratansadrusha* - reticulated in nature [7].

All this description from ancient text is on basis of inference or imaginative power i.e. *Dnyanachakshu* of the sages . With the latest knowledge of micro anatomy and physiology , these assumptions can be very well interpreted .

In human body though cell is the functional and structural unit of the body , there is no such watertight compartments as such between the two distinct and distant morphological entities.There could always exist a law of communication and functional dependence between the two apparently distinct and distant morphological entities .

Probably therefore empirically *Ashtang Sangraha* considers two types of *Srotas* , *Lakshya* - perceptible and *Alakshya* - imperceptible [8] . With today's advances, microscopic entities can be counted in *Drushya Srotas* with extended visual abilities .

Acharya Charak has very clearly said that all the biochemical molecules under metabolic processes (*Parinammapadyamana Dhatus*) are held and carried within the *Srotas* [9].

Acharya Charak further describes these *Srotas* as the functional pathways for nutritive (*Prasadakhya)* and non-nutritive or waste (*Malakhya*) molecules [10]. These pathways are spread throughout the body nourishing to all *Dhatus* at cellular level . Whatever is needful is taken up by the *Dhatus* or cells. This is normal process of nourishment of all *Dhatus* .

Srotas are the seat of all metabolic actions like transport , transformation , excretion of the concerned biochemical molecules .

Each and every smallest part of the body is made of *Panchamahabhut* [11]. All *Srotas* are also made of *Panchamahabhut* . *Srotas* is nothing but the space (*Aakash / Avakash*) defined by boundaries of *Panchabhautik* entity.

If cell is considered as functional unit or channel , it's a space defined by cell wall . All movements are carried out , to and fro into the cell .

All the visible structures by which this space is defined , are made of five primordial elements i.e. *Prithvi* , *Aap* , *Tej* ,*Vayu* and *Aakash* . *Ayurved* understands the existence of these elements by their attributes or qualities and functions , irrespective of bio chemical configuration . Thus one may classify different types of biochemical entities according to their attributes and functions as the elemental representation of *Panchamahabhut* .

Eg. Whichever body elements have heavy , stable , rough , hard qualities , which give dimensions are called *Parthiv* elements .

Whichever body elements have liquid , fluid , slow ,unctuous , soft ,slimy properties are *Apya* elements .

Whichever body elements have sharp , hot, penetrating and catalytic qualities are *Tejas* elements .

Whichever body elements have activities like expiration , inspiration , closing & opening of eyes , contraction & relaxation , movements , stimulation , controlling activities are *Vayaviya* elements .

Whichever body elements having qualities like space, porosity are *Aakashiya* elements [12] .

Any *Srotas* has qualities of *Panchamahabhutas* but it inevitably arises from some space (*Chidrat*) , conducting / flowing some element within (*Abhivahanti*) , i.e. *Srotas* [13].

Types of *Srotas* :

Mainly *Srotas* are classified in two types *Bahya* or *Bahirmukha* and *Abhyantar* or *Antarmukha* [14].

Acharya Sushrut considers 9 *Bahya* or *Bahirmukha Srotas* in males and 12 in females [14] . Whereas *Sharangdhar* considers 10 *Bahya* or *Bahirmukha Srotas* in males and 13 in females [15] .

Though conceptually *Srotas* are innumerable , *Acharya Charak* [16] and *Vagbhat* [17] consider 13 and *Acharya Sushrut* considers 11 *Abhyantar* or *Antarmukha Srotas* [18] .

Ayurvedic understanding of *Dhatus* are more by their functional aspects rather than their morphological base .

Certain *Srotas* or channels are considered for smooth functioning of the body . Each *Dhatu* has it's own *Srotas* and each *Srotas* performs different exclusive vital function . *Srotas* is nothing but functional channel in the body doing exclusive vital function .

In *Charak* and *Sushrut Samhitas* total 13 & 11 *srotas* are considered respectively. [16] [18]

Study for the thesis concerns with one of the *srotas* in the body i.e. *Pranvaha srotas* .

TABLE [1] Types of *Srotas*

	Charakokta Srotas	***Sushrutokta srotas***
1	Rasavaha srotas	Rasavaha srotas
2	Raktavaha srotas	Raktavaha srotas
3	Mansavaha srotas	Mansavaha srotas
4	Medovaha srotas	Medovaha srotas
5	Asthivaha srotas	-
6	Majjavaha srotas	-
7	Shukravaha srotas	Shukravaha srotas
8	Purishavaha srotas	Purishavaha srotas
9	Mutravaha srotas	Mutravaha srotas
10	Swedavaha srotas	*Artav-vaha srotas
11	Annavaha srotas	Annavaha srotas
12	Pranavaha srotas	Pranavaha srotas
13	Udakavaha srotas	Udakavaha srotas

Discussion :

'*Sru sarati*' means to flow , to exude , to ooze , to filter , to permeate . By etymology "*srotas*" is what , **within which something flows or carried** .

Srotas is the functional channel within the living body , concerned with one exclusive vital function , can be visible or non-visible which are the base of transformation of nutrients in biological elements , being the metabolic centre of that particular *Dhatu* , transport of nutrients and waste products . ***Srotas* are micro or macro spaces in the body which carry the different biochemical molecules during the process of metabolism .**

The internal transport system of the body , represented by *Srotas* , has been given a place of fundamental importance both in state of health and disease . Structural and functional integrity of these *Srotas* is needed in order to maintain normal physiology , likewise impairment in this integrity can lead to pathological states .

Despite *Lokpurusha Siddhanta* i.e. concept of "Simile" between Macrocosm and Microcosm *Dhatus* being functional tissues , *Mala* being excretory products and *Prana* , *Anna* and *Udaka* being the vital entities or *Bahyaprana* , have their own *Srotas* or separate functioning channels .

Characteristics of *Srotas* :

All description of *Srotas* being *sthula / sukshma* , *vrutta* , *dirgha* and *pratansadrusha* from ancient text is on basis of inference or imaginative power i.e. *Dnyanachakshu* of the sages . With the latest knowledge of micro anatomy and physiology , these assumptions can be very well interpreted .

In human body though cell is the functional and structural unit of the body . There is no watertight compartments as such between the two distinct and distant morphological entities . There could always exist a 'Law Of Communication ' and functional dependence between the two apparently distinct and distant morphological entities . Therefore empirically *Ashtang Sangraha* considers two types of *Srotas* , *Lakshya*-perceptible and *Alakshya* - imperceptible . With today's advances, microscopic entities can be counted in *Lakshya Srotas* with extended visual abilities .

According to *Acharya Charak* all the biochemical molecules under metabolic processes (*Parinammapadyamana Dhatus*) are held and carried within the *Srotas* . They are the functional pathways for nutritive (*Prasadakhya)* and non-nutritive or waste (*Malakhya*) molecules . These pathways are spread throughout the body nourishing to all *Dhatus* at cellular level . Whatever is needful is taken up by the *Dhatus* or cells. This is the usual process of nourishment of all *Dhatu* with nutrients.

Each and every smallest part of the body is made of *Panchamahabhut* . **All *Srotas* are**

also made of *Panchamahabhut* . *Srotas* is nothing but "the space" (*Aakash / avakash*) defined by boundaries of *Panchabhautik* entity. If cell is considered as functional unit or channel it's a space defined by cell porous wall . All movements are carried out , to and fro the cell . **All the visible structures by which this space is defined , are made of five primordial elements i.e. *Prithvi , Aap , Tej , Vayu* and *Aakash* . *Ayurved* understands the existence of these elements by their attributes or qualities and functions , irrespective of bio chemical configuration .**

Any *Srotas* has qualities of *Panchamahabhutas* but it inevitably arises from some space (*chidrat*) , conducting / flowing some element within (*abhivahanti*) , i.e. *Srotas* . Though conceptually *srotas* are innumerable , certain number are assumed according to their specified functions so they are 13 in number according to *Charak* and 11 according to *Sushrut* .

Moolsthana of *Srotas* :

३ ३ २१०

स्याज्जन्महेतु □प्रभव □स्थानं चाद्योपलब्धये □

जन्मनो हेतु : | 'प्रभवो जलमूले' स्याज्जन्महेतो □

ज्ञानस्य आदिमस्थाने □इति मेदिनी □

आद्योपलब्धये □

काशी संस्कृतमाला □पंडितवरश्रीमदमरसिंहविरचित नामलिङ्गानुशासन नाम अमरकोष □□

चतुर्थ संस्करण □चौखंबा संस्कृत संस्थान □वि . सं २०५७ □वाराणसी २२१००१ □भारत .

" प्रभव स्थानं " means the site of its origin or site of its birth or the site of its very beginning .

With the context to *Srotas* , *Moolsthana* of the *Srotas* is प्रभव स्थानं means its site of origin or metabolic centre of that particular biological element .

Chakrapani* has described *Mool* as *Prabhav sthana [16] means the anatomical seat of respective *Srotas* . But it also can be main seat of pathology of that *Srotas* or principle seat of manifestation of the diseases of that *Srotas* .

The cause of morbidity of *Srotas* and their manifestations first strikes the *Moolsthana* of the respective *Srotas* . This morbidity slowly spreads throughout the body by Law of functional connectivity .

Moolsthana of any *Srotas* can be determined by some logical points and been categorised [19] . i.e.

1) *Utpattisthana* - seat for origin of that element (*Dhatu* / *Mala* etc.)
2) *Sangrahasthan* - seat for storage .
3) *Vahansthana* - seat of carriage or flow of bodily elements .
4) *Naidanik sthana* - *Moolsthana* having diagnostic importance .
5) *Chikitsatmak sthana* - *Moolsthana* important in treatment of certain *Srotas* .

Moolsthana of any *Srotas* may be under one of the above mentioned category or in combination but their clinical applications are common in all categories . In some way or other *Moolsthana* of any *Srotas* could be the seat of metabolism , origin of pathological changes , having diagnostic red flag symptoms or it may be the focus of treatment .

Regarding the concept of *Srotas* and their *Moolsthana* some works have been done by various authors as follows :

1. " Concept of *Srotas* from *Ayurvedic* perspective with special reference to Neurology " by Amit Swarnakar et al. in International Journal of Allied Medical Sciences and Clinical Research (IJAMSCR) Jan-March 2014, Volume 2 , Issue 1.

Interpreted functioning of *Srotas* is completely under control of *Vayu* i.e. Nervous system and have also correlated mechanism of action potential , nerve impulses conduction with the function of *Vayu*.

2. " Review on Concept of *Srotas* " by Vandana Verma ,Sangeeta Gehlot , International Journal of Research in Ayurveda Pharmacy (IJRAP)- 5(2) , March-April 2014 .
It is a review article comprising mainly *Srotas* definition , types , characteristics , *Moolsthana* and functions .

3. " Concept of *Srotas* - an *Ayurvedic* Review " by Priyanka Burde G. , ANVESHANA Ayurveda Medical Journal Review Article , AAMJ , Vol. 1 , Issue 4 , July-August 2015 .
Review article mainly based on references from *Charak* and *Sushrut Samhita* .

4. " Anatomical consideration of *Dhamani* as *Moola* of *Srotas* in Modern Perspective " - Yadaw Bhan Pratap and Awasthi H.H. in IAMJ – Review Article International Ayurvedic Medical Journal , Volume 2 , Issue -5 , Sept.-Oct. 2014 .

5. "Anatomical consideration on *Dhamani* in Ayurveda with special reference to Susrut Samhita " - Yadaw Bhan Pratap and Awasthi H.H. in Ayurpharm International Journal of Ayurveda and Allied Sciences , Vol.3, No. 10 (2014) , Pages 299-305 .

These two papers (4&5) which discuss relation of *Sira* and *Dhamani* with *Srotas* .

6. " An Analytical outlook of determination of *Moolsthana* of *Srotas* " Pawar Pradeep Shivram et.al. in " International Research Journal of Pharmacy IRJP 3(6) , 2012 .

Discusses that *Moolsthana* cannot be only anatomical origin of the *Srotas* but many times physiologic or metabolic control centre .

7. " Critical appraisal of *Doshavaha Srotas* " - by Parameswarappa S. Byadgi in AYU-An International Quarterly Journal of Research in Ayurveda – 2012 , July-Sept. , 33 (3) , 337-342 .

Interpreted *Sira* as the synonym of *Srotas* . Manifestation of a disease occurs in the body as a result of the defective *Srotas* favouring the *Dosha - Dushya* conglomeration .

Discussion :

***Charak Samhita* commentator *Chakrapani* has described *Mool* as *Prabhav sthana* means the anatomical seat of respective *Srotas* .**

It can also be main seat of pathology of that *Srotas* or principle seat of manifestation of the diseases of that *Srotas* . The cause of morbidity of *Srotas* and their manifestations first strikes the *Moolsthana* of the respective *Srotas* .

This morbidity slowly spreads throughout the body by "Law of functional connectivity" .

Moolsthana of any *Srotas* can be classified as *Utpattisthana* , *Sangrahasthan* , *Vahansthana* , *Naidanik sthana* or *Chikitsatmak sthana*.

***Moolsthana* of any *Srotas* may be under one of the above mentioned category or in combination but their clinical applications are common in all categories . In some way or other *Moolsthana* of any *Srotas* is concerned with the seat of metabolism , origin of pathological changes , having diagnostic red flag symptoms or it may be the focus of treatment .**

From all this discussion and elaboration of the concept of '*Srotas*' , it is to be considered as the visible or non-visible channels throughout the body which are interconnected and physiologically dependant .

Because they are interdependent , health and wellbeing of one channel has potentially governing or controlling effect on the other channels too .

This principle evolves the different laws of nutrition like *Kedarkulya Nyaya* , *Ksheerdadhi Nyaya* , *Khalekapot Nyaya* etc. which signify mutual (physiologic) dependence of different *Srotas* .

Further the concept of *Moolsthana* is extension of the understanding of the concept of *Srotas* . *Moolsthan* of any *Srotas* can be anatomically different than the *Srotas* itself as its centre of control .

These non-visible channels are described as *Ayanmukhani / Gatimargani* by *Acharya Charak* .

***Moolsthana* is called *Prabhavsthana* . *Prabhava* is source or origin . Origin of the *Srotas* can be the centre of formation , transformation which can be further classified as *Sangrahasthana* and *Vahanasthana* . The origins which are under the category *Naidanik sthana* or *Chikitsatmaka sthana* might not be necessarily anatomically same as the *Srotas* . These kind of origins or *Moolsthana* are physiological governing centres and should be interpreted accordingly .**

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Shwasana & Pranavaha Srotas

Shwasana in Ayurved :

In *Ayurved* , *Shwasana* or the act of respiration as such is not described in early *Samhitas* like *Charak* and *Sushrut* though in different context function of breathing described under the functions of different types of *Vayu* . In *Sushrut Samhita* which is a prime treatise of functional Anatomy describes *Pupphusa* and *Apasthambha* i.e. can be interpreted as lungs and trachea respectively .

This is chronological review of references regarding the function of *Shwasana* .

१ प्राणोदानसमानाख्यव्यानापानै स पञ्चधा

देहं तत्त्रयते सम्यक् स्थानेष्वव्याहतश्चरन् [५]

स्थानं प्राणस्य मूर्धोर कण्ठजिह्वास्यनासिका

ष्ठीवनक्षवथूद्गारश्वासाहारादि कर्म च [६]

उदानस्य पुन स्थानं नाभ्युर कण्ठ एव च

वाक्प्रवृत्ति प्रयत्नौर्जोबलवर्णादि कर्म च [७] च . चि . २८

वायु प्राणसंज्ञाप्रदानहेतूनाम श्रेष्ठ च . सू . २५क्र३९

तत्र प्राणवहानां स्त्रोतसां हृदयं मूलं महास्त्रोतश्च च . वि . ५ क्र ९

प्राणवहानामिति प्राणसंज्ञकवातावहानाम् एतच्चं प्राणाख्यविशिष्टस्य वायो विशिष्टस्त्रोत च प्राणि . च वि ५ क्र ९

Vayu functions in living body through its five subtypes – *Prana* , *Udana* , *Samana* , *Apana* and *Vyana* . Because of their relentless functioning all physiologic movements are maintained to normalcy .

Among those , site of *Prana* is *Moordha* , *Kantha* , *Jivha* , *Aasya* , *Nasika* . ‘Breath in’ is the function of *Prana Vayu* as in the *sutra* whereas ‘ breath out ’ is the function of *Udana Vayu* as naval region (*Nabhi*) , chest cavity (*Urah*) , windpipe (*Kantha*) is the area of functioning for *Udana Vayu* .

Among all vital entities , *Vayu* is considered as most vital in living body according to *Acharya Charak* .

In *Vimanasthana* , *Acharya Charak* has mentioned *Hriday* and *Mahasrotas* as *Moolsthana* of *Pranavaha srotas* .

Chakrapani has explained that vital *Pranavayu* is conducted through the *Srotas* .

२) ' शोणिफेनप्रभव : फुफ्फुस :' ‖ सुश्रुत शारीरस्थान ४/२५

फुफ्फुसो हृदयनाडिकालग्न□□ डल्हण

वायुर्यो वक्त्रसंचारी स प्राणोनाम देहधृक् □

सोऽत्रं प्रवेशयत्यन्त□**प्राणांश्चाप्यवलंबते** □

प्रायश □करूते दुष्टो हिक्काश्वासादिकान् गदान □सु . नि . १क्र१३□१४

तेन मूर्धोर□कंठनासिका अपि प्राणस्य स्थानम् एतेन प्राणधारहृदयधारणेन प्रांणधारणमेवोत्तक्म् □

सु . नि . १क्र १३□१४ **डल्हणटीका**

प्रश्वास □अंत □प्रविशद् वायु □□उच्छ्वास □ऊर्ध्वम् उत्तिष्ठद् वायु □□अमरकोष खंड १क्र६४ डल्हण

श्वसन् □स्पर्शनो वायुर्मातरिश्वा सदागति □□अमरकोष खंड १क्र६४ डल्हण

ऊर्थ्वगा □धमन्य □शब्दस्पर्शरूपरसगंधप्रश्वासोच्छ्वासजृंभितक्षुद्धसितकथितंरूदितादीन्

विशेषान् अभिवहन्त्य □शरीरं धारयन्ति □सु . शा . ९ क्र ५

उभयत्र उरसो नाडयो वातवहे अपस्तंभौ नाम तत्र वातपूर्णकोष्ठतया कासश्वासाभ्यां च

मरणम् □सु . शा . ६क्र२५

According to *Acharya Sushrut Puppusa* are formed from blood froth .

Puppusa is attached to *Hriday* (*Dalhan*) .

In *Sushrut Sharirsthana sutra* clearly mentioned , *Nadis* conduct *Vayu* in chest cavity and *Apasthambha* .

Urdhwaga Dhamanis are supposed to be involved in *Shwasana Karma* or the act of respiration .

Kasa and *Shwasa* are mentioned as diseases of these structures involving *Puppusa* , *Apasthambha* and *Vatapurna Koshtha* .

३□दोषधातुमलमूलं सदा देहस्य. तं चल □□

उत्साहोच्छ्वासनिश्वास चेष्टावेगप्रवर्तने □□ अ . हृ . सू . ११क्र१

- उच्छ्वास□ऊर्ध्वश्वसनं श्वासमुक्ति □□निश्वास □श्वासस्य शरीरान्त □प्रवेशनम् □अ□पादत्त
- उच्छ्वास □श्वासनिर्गम □निश्वास श्वासप्रवेश □□हिमादि

Act of Breathing is a sign of a Living object and उच्छ्वास is exhalation and निश्वास is taking breath in , is the interpretation done by commentators *Arundatta* and *Hemadri* of *Vagbhat* .

Dalhan commentator of *Sushruta* also interprets प्रश्वास inhalation and उच्छ्वास as exhalation .

प्राणो ऽत्र मूर्धगा□□उरः□कण्ठचर□□

ष्ठीवनक्षवथूद्गारनिश्वासा□प्रवेशकृत् □ अ.हृ.सू.१२क्र४

प्राणस्य मूर्धा अवस्थितिस्थानम् □उरः□कण्ठश्च विचरणस्थानम् □

हेमाद्रि अ. हृ.सू.१२क्र ४

उर□स्थानम् उदानस्य नासानाभिगलांश्चरेत् □ अ.हृ.सू.१२क्र५

उदानस्य उरो**वस्थितिस्थानम् □नासादि विचरणस्थानम् □हेमाद्रि अ. हृ.सू.१२क्र ५**

Prana and *Udana* are the types of *Vayu* mainly involved in the function of respiration . *Prana* resides in head or *Moordha* but it functions in area of *Urah* (chest) and *Kantha* (trachea) .

Urah or Chest is the main site of *Udana* and Nasal cavity , *Kantha* or trachea up to Naval region is its functional area .

Pranavayu is mainly related with the act of inhalation i.e. *Nishwasa* whereas *Udana* is with exhalation .

४□श्वसनकर्म

शिरा धमन्यो नभिस्था□सर्वा व्याप्य स्थितास्तनुम् □

पुष्यन्ति चानिशं वायो□ संयोगात् सर्वधातुभि□□

नाभिस्थ□प्राणपवन□स्पृष्ट्वा हृत्कमलान्तरम् □

कंठात् बहिर्विनिर्याति पातुं विष्णुपदामृतम् □

पीत्वा चांबरपीयूषं पुनरायातिवेगत□□

प्रीणयन्देहमखिलं जीवयञ्जठरानलम् □

शरीरप्राणयोरेव संयोगादायु□च्यते □ शा.खं.१ □अ.५ □श्लो.४७ ४९

In *Sharangadhar Samhita* function of respiration is elaborately described in above *sutra* . All *Sira* and *Dhamani* situated at *Nabhi* revitalise the whole body by supplying

Pranavayu to the body without cease .

Nabhistha vayu touches *Hriday* to get *Vishnupadamruta* and get purified .

Taking *Ambarapiyush* i.e. vitality again goes back to whole body to give satiety .

Thus this function maintains the continuity of life .

उदानवायोराधार□फुप्फुस□प्रोच्यते बुधै □□शा . खं . १ □अ . ५ □श्लो . ४३

Puppusa are considered as seat of *Udana Vayu* .

In Ayurveda *Puppusa* , *Vatapurna* Koshtha etc. are described as organs of respiration . According to *Ayurvedic* consideration acceptance of oxygen and its dissemination to all cells comes under control of *Prana* and *UdanaVayu* . *Nishwasa* is interpreted as Inspiration and *Ucchwasa* is interpreted as Expiration . *Avalambak Kapha* placed in chest cavity maintains the compliance to ease the respiratory movements .

Discussion :

1) Among five subtypes of *Vayu* , site of *Prana* is *Moordha* , *Kantha* , *Jivha* , *Aasya* , *Nasika* . **which quite resembles with the pathway of respiratory function from its centre in the brain to actual breathing process taking place through nose , trachea etc. One can easily interpret the function of breathing through these *Vayu* which goes on through Respiratory centre in brain (Pons , Medulla) , trachea , all structures in mouth and Nose .**

'Breath in' is the function of *Prana Vayu* as in the *sutra* whereas ' breath out ' is the function of *Udana Vayu* as naval region (*Nabhi*) , chest cavity (*Urah*) , windpipe (*Kantha*) is the area of functioning for *Udana Vayu* .

2) According to *Acharya Sushrut Puppusa* are formed from blood froth .

***Puppusa* is attached to *Hriday* (*Dalhan*) , means *Puppusa* are nothing but lungs attached to Heart in thoracic cavity .**

This description equals with the Heart Lung machine and the alveolar structure which is surrounded by meshwork of capillaries for gaseous exchange .

In *Sushrut Sharirsthana sutra* clearly mentioned *Nadis* conducting *Vayu* in chest cavity and *Apasthambha* i.e. Bronchial tree . *Urdhwaga Dhamanis* are supposed to be involved in *Shwasana Karma* or the act of respiration . ***Vata Poorna Koshtha* can**

be interpreted as inflated alveoli attached to *Apasthambha* .

Kasa and *Shwasa* are mentioned as diseases of these structures involving *Puppusa* , *Apasthambha* and *Vatapurna Koshtha* .

3) In the act of Breathing **, उच्छ्वास is exhalation and निश्वास is taking breath in , is the interpretation done by commentators *Arundatta* and *Hemadri* . *Dalhan* commentator of *Sushruta* also interprets प्रश्वास inhalation and उच्छ्वास as exhalation .**

Prana and *Udana* are the types of *Vayu* mainly involved in the function of respiration . *Prana* resides in head or *Moordha* but it functions in area of *Urah* (chest) and *Kantha* (trachea) .

Urah or Chest is the main site of *Udana* and Nasal cavity , *Kantha* or trachea up to Naval region is its functional area (*Vicharana Sthana*) .

***Pranavayu* is mainly related with the act of inhalation i.e. *Nishwasa* whereas *Udana* is with *Uchwasa* .**

4) In *Sharangadhar Samhita* function of respiration is elaborately described in an exclusive *sutra* .

All *Sira* and *Dhamani* situated at *Nabhi* revitalise the whole body by supplying *Pranavayu* to the body without cease .

Nabhistha vayu touches *Hriday* to get *Vishnupadamruta* and get purified .

Taking *Ambarapiyush* i.e. vitality again goes to whole body to give satiety to whole body . Thus this function maintains the continuity of life .

Moolsthana of *Pranavaha Srotas* and it's significance in *Tamakashwasa* :

This thesis study is concerned with *Pranavaha Srotas* .

१ तत्र प्राणवहानां स्रोतसां हृदयं मूलं महास्रोतश्च चरक विमानस्थान ५/७/१३

अतिसृष्टम् अतिबद्धम् कुपितम् अल्पाल्पम् अभीक्ष्णं वा सशब्दशूलमुच्छ्वसंतं दृष्ट्वा प्राणवहान्यस्य स्रोतांसि प्रदुष्टान् इति विद्यात् चरक विमानस्थान ५/७/१३

कोष्ठ पुन उच्यते महास्रोत शारीरमध्यं महानिम्नमामपक्वाशयश्चेति पर्यायशब्दैस्तन्त्रे रोगमार्ग आभ्यन्तर

चरक सूत्रस्थान ११क्र४८

पित्तस्थान नाभिरामाशय स्वेदो लसिका धिरं रस अष्टांगहृदय सू १२क्र२

२ तत्र प्राणवहे द्वे तयोर्मूलं हृदयं रसवाहिन्यश्च धमन्य सुश्रुत शा. ९क्र१२

वायुर्यो वक्त्रसंचारी स प्राणोनाम देहधृक्

सोऽत्रं प्रवेशयत्यन्त **प्राणांश्चाप्यवलंबते**

प्रायश कुरूते दुष्टो हिक्काश्वासादिकान् गदान सु. नि. १क्र१३/१४

३ कफ वातात्मकावेतौ पित्तस्थानसमुदभवौ च. चि. १७क्र८

पित्तस्थानसमुद्भवावित्यनेन पित्तस्योर्ध्वस्थानसंबंध एव न तु वातकफवदारम्भक्त्वमिति दर्शयति

पित्तस्थानशब्देनामाशयोऽभिप्रेत चक्राणि टीका

४ प्राणोदकान्नवाहानां दुष्टानां श्वासिकी चिा च. वि. ५

५ तमके तु विरेचनम् च. चि. १७/१२१

According to *Charak Samhita Hridaya* and *Mahasrotas* are two *Moolsthana* of *Pranavaha Srotas* .

Moolsthana of *Pranavaha Srotas* according to *Acharya Sushrut* are Heart and *Dasha dhamani* carrying *Prana* .

Acharya Charak has mentioned *Mahasrotas* , as *Moolsthana* of *Pranavaha Srotas* .

According to *Acharya Charak* and *Acharya Sushrut* both consider *Tamakashwasa* a disease of *Pranavaha Srotas* .

In *Chikitsasthana Acharya Charak* has categorised *Shwasa* or Bronchial Asthma as disease of *Pranavaha Srotas* i.e. Respiratory System , to be *Amashayottha vyadhi* i.e. disease pathology originating from *Amashaya* of *Mahasrotas* . This is the key subject of concern of this thesis work . This thesis work attempts to interpret this concept of

Mahasrotas as *Moolsthana* of *Pranavaha Srotas* with special reference to *Tamak shwasa* i.e. Bronchial Asthma .

Regarding the concept of *Pranavaha Srotas* and their *Moolsthana* some works have been done by various authors as follows :

1. " A Review on Respiratory System Physiology as described in Ayurveda " Vandana Verma et.al. in International Journal of Research in Ayurved Pharmacy 5(4) , July-August 2014 .

2. " A review of *Pranavaha Sroto Moolsthanas* " by Deeja C R et.al. International Journal of Aplied Ayurved Rsearch - IJAAR -Vol. 1 , Issue 2 Nov.-Dec. 2013 .

3. " Pathophysiology , prevention , diagnosis and management of the disorders of Pranavaha Srotas (Respiratory System) in children " First Edition , January 2015 Publisher : Chaukhamba Orientalia , Varanasi , Editors : Singh BM , Gehlot S , Patwardhan K , Tripathy NS , Upadhyaya PS , Chapter 15 - pp 51- 66 .

Important and relevant references showing involvement of GIT in asthma :

1) " Gut and Bronchus associated lymphoid tissue " - John Bienenstock & Dean Befus . American Journal of Anatomy - July 1984 , volume -170, Issue 3,Page 437-445 Bronchus associated and Gut associated lymphoid tissues (BALT & GALT) have both functional and morphological similarities and are involved in seeding lung ,gut and other mucosal sites with predominantly Ig A containing B cells .

2) " Gastrointestinal symptoms in patients with asthma " - Dr. Carlo Caffarellia et.al. BMJ - Archives on diseases in children . 2000.82:131-135 . Occurance of gastrointestinal symptoms appear to be common in children with asthma . There can be positive relationship between asthma and the gastrointestinal tract .

Gastrointestinal abnormalities have been reported in patients with asthma . Intestinal permeability appears to be increased in asthma . Food challenges have been shown to elicit wheezing in small portion of children .

Gastrointestinal reflux can be provocative factor in asthma .

3) " Gut feeling about IBS " – Stefan M Stahl , MD, Ph. D.

Brainstorm monthly section of Journal of Clinical Psychiatry , 09/2001 , 62(8) : 590-1 .

The gut is controlled peripherally by little brain namely the enteric nervous system , derived from same neural crest as the CNS . Gut motility is regulated by

neurotransmitters of enteric neurons that innervate the bowel and also neurotransmitters in brain regions such as the locus ceruleus and vagal nerve centre .

4) " Acid reflux Asthma link - Explained " - Digestive Health Institute , Norm Robillard , August 7, 2010 .

As many as 80% of asthmatic patients suffer from abnormal gastrointestinal reflux compared to about 20-30% of non-asthmatics . Some asthmatic have GERD with classic symptoms while others shown to have GERD by p H monitoring don't have classic symptoms are considered to have 'silent' GERD .

The most common symptoms in GERD include abdominal pain , cough , sour throat , sour taste , hoarseness , laryngitis , asthma like symptoms and sinus irritation .

5) " The impact of asthma on the gastrointestinal tract (GIT) " - Warren Antonio Vieira , Etheresia Pretorius .

Journal of Asthma and Allergy - September 2010 ; 3: 123-130 .

Both the respiratory tissues (BALT) and gut associated mucosal surface (GALT) have numerous common morphological and functional characteristics , with the mucosal immunological system believed to be one such common feature .

6) "Evaluation of Role of *Nityavirechan* and *Nayopayam Kashay* in *Tamak Shwasa* " , *Prasad M Shyam* et.al. in AYU 2010 July-Sept.31(3) : 294-299 .

7) " Clinical effects of *Virechana* and *Shaman Chikitsa* in *Tamak Shwasa* (Bronchial Asthama) " , Ghosh K A , Tripathi P C

AYU 2012 Apr. : 238-42

These references give us some shades of common things between the concept of *Mahasrotas* as *Moolsthana* of *Pranavaha srotas* . This thesis work aims to throw light over the association of *Mahasrotas* as *Moolsthan* and *Pranavaha srotas* .

The study regarding the thesis is about the *Pranavaha Srotas* and it's *Moolsthana* . As said previously *Srotas* are the functional channels of the body and their *Moolsthana* are either *Utpattisthana* (metabolic centre) , *Niyamanasthana* (governing centre) or *Parikshanasthana* (assessment centre) .

Aim of the study is to validate the concept of *Pranavaha Srotas Moolsthana* with special reference to *Pranavaha Srotas* disease *Tamak Shwasa* .

Tamakshwasa is the major disease of *Pranavaha Srotas* . This thesis work is focussed mainly on the conceptual part of *Ayurvedic* principle of *Pranavaha Srotas* and its *Moolsthana* , to interpret it in new perspective which will enable researchers to get new

insights in understanding pathophysiology and the principles of line of treatment of *Tamakshwasa* . It may give new dimensions to existing understanding of pathophysiology of *Tamakshwasa* . This work will add new facets to existing knowledge .

Discussion :

According to *Acharya Charak Hriday* and *Mahasrotas* are two *Moolsthana* of *Pranavaha Srotas* .

According to *Acharya Sushrut Moolsthan* of *Pranavaha Srotas* are *Heart* and *Dasha dhamani* carrying *Prana* .

According to *Acharya Sharangadhara* , *Nabhi* is the *Moolsthana* of *Pranavaha srotas* . *Acharya Charak* and *Sushrut* both consider *Hriday* (Heart) as *Moolsthana* .

- ***Hriday Moolsthana* as *Vahanasthana* :**

***Hriday* (thoracic heart) is associated with the actual gaseous exchange between external & internal air so can be interpreted as *Vahanasthana* .**

The act of '*Shwasochwasa Kriya*' i.e. respiration is the physiological function of *Pranavayu* . *Moordha* is the seat of *Pranavayu* .

The *Pranavaha Srotas* means a channel or path through which the external air enters into the body to sustain life . '*Shiras*' (head) is considered as the seat of *Indriyas* and *Pranavahi Srotas* in *Charak Samhita* .

Pranavayu initiates it's impulse from '*Shiras*' and travels till '*Uras*'(chest) enabling intake of air , food and expulsion of air (expiration or *Ucchwasa*) and phlegm.

- ***Hridaya* as *Naidanik* type of *Moolsthana* :**

***Hridaya* can also be considered as *Naidanik* type of *Moolsthana* of *Pranavaha Srotas* ;** as *Acharya Charak* mentions *Hridroga* originating from *Shramashwas* or *Kasadharana* (withholding *Shramashwasa* / *Kasa*-cough) and also '*Kasa*' and '*Shwasa*' are cardinal symptoms of *Hridroga* .

In *Pranavaha Srotodushti Lakshanas* , *Acharya Charak* describes all disturbed lung functions during respiration , also mentions that these should be treated as the treatment

guideline or principle of *Shwasa* .

- ***Dash Dhamanis* as *Pranavaha Srotas Moolsthana* by *Acharya Sushrut* :**

Acharya Sushrut has considered '*Dash Dhamanis*' also as *Pranavaha Srotas Moolsthana* .

***Hridaya* or heart or the cardiac region and big arteries and veins (*Pranavahi dhamanyaha*) are obvious *Moolsthana* or centre of *Pranavaha Srotas* as it is directly concerned with carrying of *Prana* i.e. oxygen , being the centre of circulation . Further *Prana* is transported and disseminated up to cellular level by vascular system (*Rasavahi dhamani*) .**

So according to *Acharya Sushrut* , *Hriday* (heart) & *Pranavahi* , *Rasavahi Dhamani* are the *Moolsthana* of *Pranavaha Srotas* . This could be centre of transport or *Vahanasthana* .

After first phase of respiration (or gaseous exchange/external respiration) at lungs , one more phase of respiration take place at tissue level. Tissues give up or expire their not wanted gases and take up oxygen (or '*Prana*') loaded in the blood. This is termed as tissue respiration or 'Internal respiration' and this happens through tissue fluid and plasma, **as oxygen and carbon dioxide both gases are in dissolved form in either plasma or tissue fluid.**

This modern science knowledge explains why *Acharya* must have taken '*Dasha Dhamanis*' as *Moolsthana* of *Pranavaha Srotas* as the mode of transportation. Oxygen which has reached to blood during external respiration (through heart & lungs) is circulated up to each cell of the body through great arteries and their offshoots through the medium of plasma or tissue fluid in dissolved state.

- ***Nabhi* as the *Moolsthana* of '*Pranavaha Srotas*' according to *Acharya Sahrangadhara* :**

Acharya Sharangadhar considers '*Nabhi*' as the *Moolsthana* of '*Pranavaha Srotas*'. According to the commentary over that by *Adhmalla* in *Gudhartha Sandipani* , '*Nabhisth*' is '*Hridaysth*'.

Heart with great vessels attached to it is the *Moolsthana* . So not just the heart but the whole heart lung machine is the *Moolsthana* of *Pranavaha Srotas*.

So according to *Acharya Charak* , *Sushrut* & *Sharangadhar* , thoracic heart with great

vessels i.e. *Dasha Dhamanis* are *Moolsthana* as they are *Vahansthana* or seat of transportation of *Prana*.

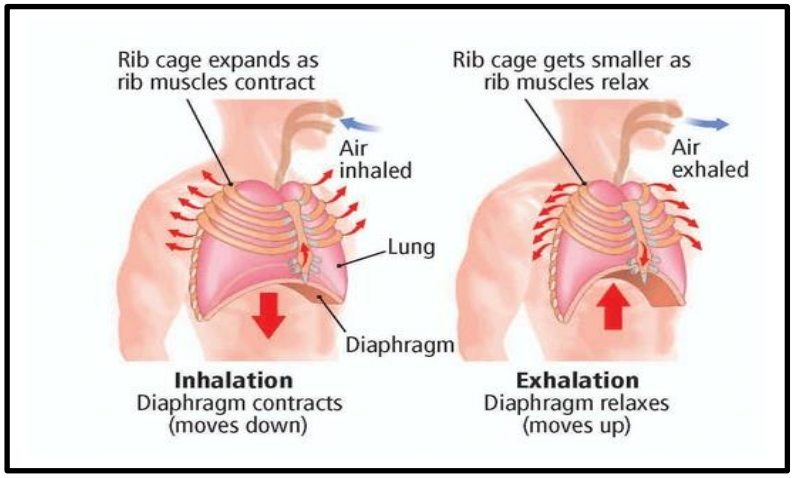
Kinesiology of Thoracic and Abdominal Cavities and it's *Ayurvediya* interpretation of *Nabhi* as a *Moolsthana* of *Pranavaha Srotas* :

In the process of respiration along with heart and lung machine , diaphragm and other major thoracic and abdominal muscles play a major role in smooth functioning of *Pranavaha Srotas* i.e. process of respiration . Because of powerful contraction and subsequent relaxation of these muscles especially diaphragm , lungs can be expanded , more space made available for lung respiration .

Diaphragm with it's great contractility enables the functions of *Prana* and *Udana* i.e. taking air inside the body (*Nishwas*) of *Prana* and expelling it out of body by *Udana* (*Uchhwasa*) .

Acharya Sharangadhara also mentions *Puppusa* as *Adhara* of *Udanavayu* which does *Uchwasa kriya* (process of expiration) .

Figure [1] Movements of thoracic cage



In process of inhalation , the diaphragm contracts and is drawn inferiorly into abdominal cavity until it is flat . At the same time , internal intercostal muscles between the ribs elevate the ribcage like bucket handle . Thoracic cavity becomes deeper

and larger , drawing in air from the atmosphere . During exhalation ,the ribcage drops to it's resting position while the diaphragm relaxes by elastic recoil and elevates to it's dome shaped position in the thorax . Air within the lungs is forced out of the body as the size of thoracic cavity decreases .

Figure [2] Diphragm

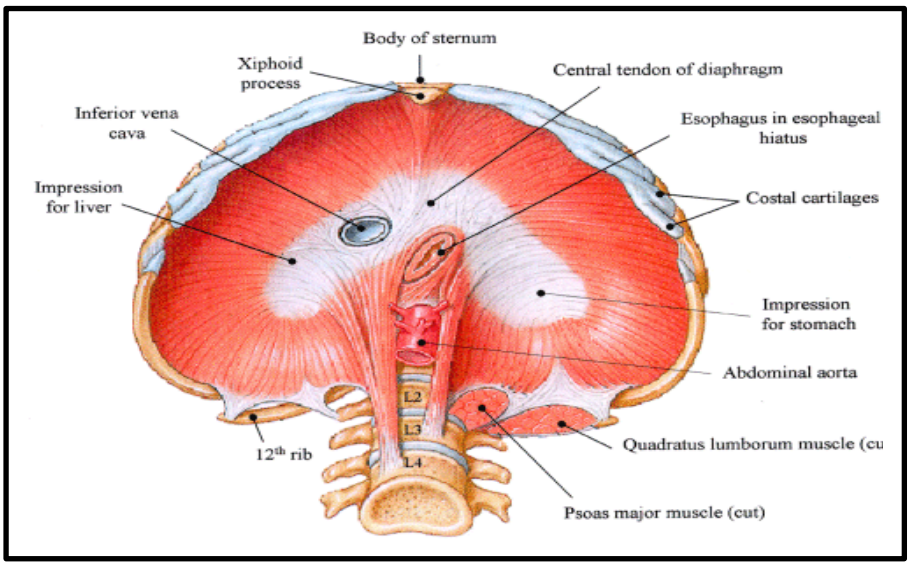
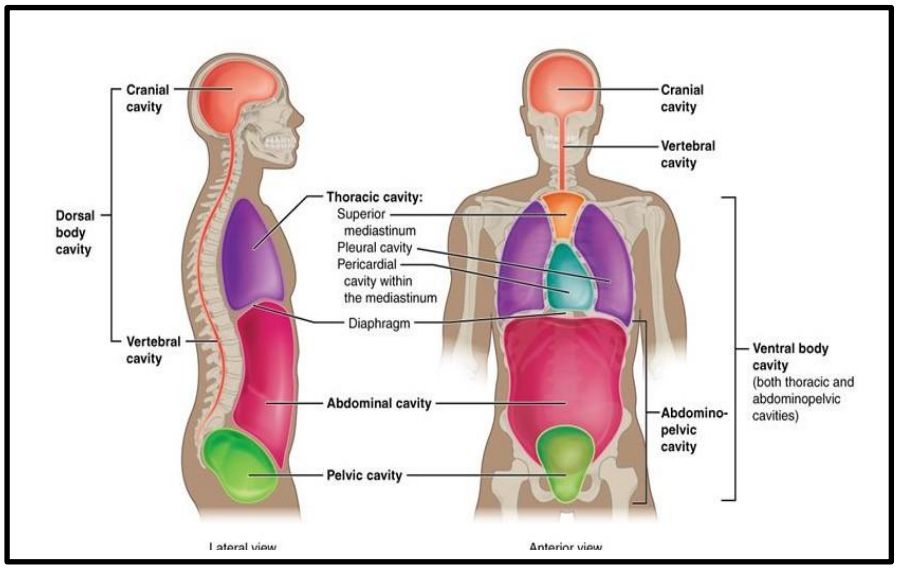


Figure [3] Abdominal & Thoracic cavities



Anatomically , diaphragm divides body into two major cavities i.e. thoracic and abdominal . It is also involved in non-respiratory functions - like helping to expel

vomit , faeces and urine from the body by increasing intra-abdominal pressure on oesophagus as it passes through the oesophageal hiatus of diaphragm .

With context to *Ayurvediya* understanding , **diaphragm functions appear to help functioning of *Prana, Udana , Samana* and *Apana* vayu in different directions .i.e. *Prana* action is from outside towards within the body , *Udana* acts from within towards out , *Samana* governing all digestive organs and their physiological secretary and propulsive movements and *Apana* from umbilical level to downward and out of the body .**

The Diaphragm is the muscle which equilibrates the pressures from both the cavities - thoracic and abdominal .

Most commonly when abdomen gets bloated because of reverse peristalsis , diaphragm gets pressurised and it disturbs it's contraction & relaxation activities , disturbing the movements from both upward and downward directions . This is probably described as '*Udavarta*' in *Ayurveda* .

Thus pressured diaphragm creates mechanical disturbance in the movements of respiration .

With this understanding one can understand the view of *Acharya Sharangadhara* considering *Nabhi* as *Moolsthana* of *Pranavaha Srotas* .

Nabhi comprises naval region with the abdominal muscles and diaphragm . It is an important structure which regularises the pressures between thoracic and abdominal cavities . Any mechanical disturbance in this , disturbs act of respiration and movements in abdominal organs as well . **If *Nabhi* is interpreted as umbilicus this explanation gives insight in considering it as *Moolsthana* of *Pranavaha Srotas* as *Niyamana sthana* .**

- **" *Mahasrotas* " As " *Moolsthana* " Of " *Pranavahasrotas* " With Context To " *Tamakashwasa* " :**

According to *Charak Samhita* "*Mahasrotas*" is the "*Moolsthana "* of *Pranavaha Srotas* . As discussed earlier *Moolsthana* of *Srotas* can be its pathological centre of origin .

In case of *Pranavaha Srotas Acharya Charak* and *Sushrut* both have given *Hriday* as

moolsthana which is obviously *Vahanasthana* .

Only *Acharya Charak* has mentioned *Mahasrotas* as an additional *Moolsthana* . *Acharya Charak* has also very clearly considered *Shwasa* or Bronchial Asthma as *Aamashayottha Vyadhi* i.e. its pathology originating from *Aamashaya* / *Mahasrotas* .

***Acharya Charak* being from school of Physicians , has focussed on treatment perspective and origin of pathology rather than anatomical perspective . Although kinesiology or dynamics of *Mahasrotas* or gastrointestinal tract greatly influence dynamics of Respiratory and Cardiovascular Systems as discussed earlier .**

Chronic helminthiasis , flatulence , gastric acid reflux , chronic constipation , any digestive disturbance etc. are accepted as additional etiological or triggering factors in etio-pathogenesis of Bronchial Asthma .

***Mahasrotas* is interpreted as the space or *Koshtha* and been divided into *Amashaya* and *Pakwashaya* . It is also been considered as *Abhyantara Rogmarga* or the innermost pathological pathway .**

***Tamakshwasa* disease of *Pranavaha Srotas* is a disease believed to be originated from *Pittasthana* . *Chakrapani* (commentator of *Charak Samhita*) interprets *Pittasthana* as upper part of *Amashaya* i.e. digestive system which is the seat of *Pitta* .**

***Acharya Charak* has defined *Amashaya* spreading from *Nabhi* to *Stana* i.e. the area between umbilicus to breast comprising the whole digestive system .**

***Chakrapani* explains that upper part of *Amashaya* which is seat of *Pitta* or *Agni* , has to be considered as seat or origin of pathology of *Tamakshwasa* .**

Thus *Tamakashwasa* disease of respiratory system is said to be originated from '*Pittasthana*'.

Though the syptoms of *Tamakashwasa* are *Kapha-Vatatmaka* , *Pittadushti* and *Pittasthanadushti* is predisposing in *Samprapti* of *Tamakashwasa* .

Clinically , symptoms like abdominal pain , diarrhoea , vomiting are commonly present in asthmatics along with many others like abdominal distention (*Anaha*) , constipation (*Malavashtambha*) , eructation (*Udgar*) , flatulence (*Atopa*) and regurgitation or acid

reflux . Food can also provoke airway reactivity .

Food challenge has been shown to elicit wheezing in small proportion . Gastrointestinal reflux is a significant provocating factor in asthma .

Bronchus Associated Lymphoid Tissues (BALT) and Gut Associated Lymphoid Tissues (GALT) have numerous common morphological and functional characteristics , with the mucosal immunological system believed to be one such common feature .

Overlapping pathological features are described in literature between body's lungs , airways and stomach , small intestines , underlines strong connection between two having same pathophysiological pathway .

These findings also strongly supports the concept of Asthma / *Tamakashwasa* being '*Pittasthansamudbhava*'.

Charak Samhita **(from where the basic concept of study has been taken) is a treatise of the school of Physicians. All the basic principles envisaged in it , are from applied point of view in treatment .**

Principles of *Ayurved* are empirical, essence of observations of many thousands of years , so they **are better understood in light of their clinical application** rather than co relating them one to one with any modern parameter .

Respiratory System

Anatomy & Physiology

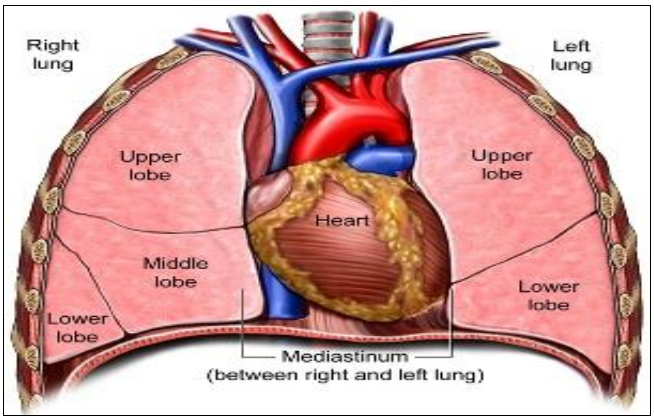
Anatomy Physiology Of The respiratory system

The organs of the respiratory system function so that oxygen enters our bodies and carbon dioxide leaves .

The respiratory tract is the path of air from the nose to the lungs. It is divided into two sections: Upper Respiratory Tract and the Lower Respiratory Tract. The upper respiratory tract includes in are the Nostrils, Nasal Cavities, Pharynx , Epiglottis , and the Larynx. The lower respiratory tract consists of the Trachea , Bronchi , Bronchioles , and the Lungs . As air moves along the respiratory tract it is warmed, moistened and filtered.

The lungs flank the heart and great vessels in the chest cavity.

Position of Lungs in Chest Cavity - Figure [4]



Functions :

Body cells continuously use oxygen (O_2) for the metabolic activities that release energy from nutrient molecules and produce ATP . At the same time ,these reactions release carbon dioxide (CO_2) . Because of excessive amount of CO_2 produces acidity that can be toxic to cells, excess CO_2 must be eliminated quickly and efficiently . Respiratory system along with Cardiovascular system function to supply O_2 and eliminate CO_2 . The Respiratory system provides for gas exchange intake of O_2 and elimination of CO_2 and the cardiovascular system transports blood containing the gases between the lungs and body cells . This maintains homeostasis .

There are four processes of respiration. They are:

1. Breathing or Pulmonary ventilation
2. External respiration , which is the exchange of gases (oxygen and carbon dioxide) between inhaled air and the blood.
3. Internal / Tissue respiration , which is the exchange of gases between the blood and tissue fluids.
4. Cellular respiration - gaseous exchange and ATP production .

In addition to these main processes, the respiratory system serves for:

1. Regulation of blood pH, which occurs in coordination with the kidneys
2. Defence against microbes
3. Control of body temperature due to loss of evaporate during expiration

Breathing and Lung Mechanics :

Ventilation is the exchange of air between the external environment and the alveoli. Air moves by bulk flow from an area of high pressure to low pressure. All pressures in the respiratory system are relative to atmospheric pressure (760 mm Hg at sea level) . Air will move in or out of the lungs depending on the pressure in the alveoli. The body changes the pressure in the alveoli by changing the volume of the lungs. As volume increases pressure decreases and as volume decreases pressure increases. This inverse relationship between volume and pressure , called Boyle's Law . Differences in pressure caused by changes in lung volume force air into lungs during inhalation and out during exhalation.

There are two phases of ventilation; inspiration and expiration . The body is able to stay at the dimensions of the lungs because of the relationship of the lungs to the thoracic wall. Each lung is completely enclosed in a sac called the pleural sac . The parietal pleura is attached to the thoracic wall whereas the visceral pleura is attached to the lung itself. In-between these two membranes is a thin layer of intrapleural fluid. The intrapleural fluid completely surrounds the lungs and lubricates the two surfaces so that they can slide across each other. Changing the pressure of this fluid also allows the lungs and the thoracic wall to move together during normal breathing .

Muscles helping thoracic movements during Breathing :

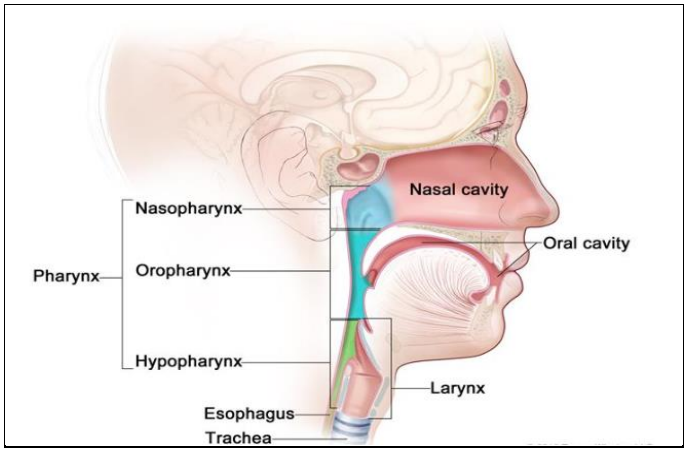
The most important muscle of inhalation is diaphragm ,the dome shaped skeletal muscle that forms the floor of thoracic cavity . Contraction of diaphragm causes it to flatten and lowering its dome . This increases the vertical diameter of the thoracic cavity . Contraction of diaphragm is responsible for about 75% of the air that enters in lungs during quiet breathing .

The next important muscles of inhalation and exhalation are the external intercostal . When these muscles contract , they elevate the ribs . As a result , there is an increase in anteroposterior and lateral diameters of the chest cavity . Contraction of the internal intercostal is responsible for about 25% of the air that enters in lungs during quiet breathing . Normal inhalation involve muscular contraction , is said to be active . Normal adults have a breathing rate of 12-20 respirations per minute.

The Pathway of Air :

When one breathes air in at sea level, the inhalation is composed of different gases. These gases and their quantities are - Oxygen which makes up 21%, Nitrogen which is 78%, Carbon Dioxide with 0.04% and others with significantly smaller portions.

Nasal and Laryngeal pathway of Air - Figure [5]



In the process of breathing, air enters into the nasal cavity through the nostrils and is filtered (macro particles , Dust, pollen, smoke, and fine particles) by coarse hairs (*vibrissae*) and mucous that are found there. It also gets moisten, and warmed . Air then travels past the

nasopharynx , oropharynx , and laryngopharynx , which are the three portions that make up the pharynx.

The tonsils which are part of the lymphatic system , protect against foreign invasion of antigens . Then the air travels through the larynx. The larynx is also our voice box; it contains vocal cords, in which sound is produced by vibration of the vocal cords when air passes through them.

The trachea, which is also known as our windpipe , has ciliated cells and mucous secreting cells lining it which protects from dust and other particles , and is held open by C-shaped cartilage rings. The mucocilliary escalator extends from the top of the trachea all the way down to the bronchioles . Through the trachea, the air is now able to pass into the bronchi.

Inhalation / Inspiration :

Inspiration is initiated by contraction of the diaphragm and in some cases the inter-costal muscles when they receive nervous impulses. During normal quiet breathing, the phrenic nerves stimulate the diaphragm to contract and move downward into the abdomen. This downward movement of the diaphragm enlarges the thorax. When necessary, the intercostal muscles also increase the thorax by contacting and drawing the ribs upward and outward.

As the diaphragm contracts inferiorly and thoracic muscles pull the chest wall outwardly, the volume of the thoracic cavity increases. As the thoracic cavity increases in volume the lungs are pulled from all sides to expand, causing a drop in the pressure (a partial vacuum) within the lung itself. Air from the external environment then follows its pressure gradient down and expands the alveoli of the lungs, where gas exchange with the blood takes place.

Exhalation / Expiration :

During quiet breathing , expiration is normally a passive process and does not require muscles to work (rather it is the result of the muscles relaxing) . When the lungs are stretched and expanded, stretch receptors within the alveoli send inhibitory nerve impulses to the medulla oblongata , causing it to stop sending signals to the rib cage and diaphragm to contract . The muscles of respiration and the lungs themselves are elastic, so when the diaphragm and intercostal muscles relax there is an elastic recoil, which creates a

positive pressure (pressure in the lungs becomes greater than atmospheric pressure) , and air moves out of the lungs by flowing down its pressure gradient .

We have some voluntary control over respiration due to the higher brain function of the cerebral cortex.

Another function of the respiratory system is to sing and to speak by exerting conscious control over our breathing and regulating flow of air across the vocal cords we are able to create and modify sounds.

Lung Compliance :

Lung Compliance is the magnitude of the change in lung volume produced by a change in pulmonary pressure. Compliance can be considered as flexibility of ribcage .

A low lung compliance would mean that the lungs would need a greater than average change in intrapleural pressure to change the volume of the lungs.

A high lung compliance would indicate that little pressure difference in intrapleural pressure is needed to change the volume of the lungs.

Determination of Lung Compliance :

Two major things determine lung compliance.
1) Elasticity of the lung tissue . Any thickening of lung tissues due to disease will decrease lung compliance
2) The second is surface tensions at air water interfaces in the alveoli . To overcome the forces of surface tension, certain alveoli cells (Type II pneumocytes) secrete a protein and lipid complex called ""Surfactant"", which acts like a detergent by disrupting the hydrogen bonding of water that lines the alveoli, hence decreasing surface tension.

Control of respiration :
Central control

The rhythm of ventilation is also controlled by the "Respiratory Centre" which is located largely in the Medulla Oblongata of the brain stem. This is part of the autonomic system and

as such is not controlled voluntarily (one can increase or decrease breathing rate voluntarily, but that involves a different part of the brain).

The respiratory centre can be divided into three areas on the basis of their functions :
1) Medullary rhythmicity area in medulla oblongata – regulates rhythm of inspiration and expiration .
2) The Pneumotaxic area in the pons – regulates the duration of inhalation by cutting off its time when lungs are full .
3)The Apneustic area in pons co-ordinates transition between inhalation and exhalation .

Peripheral control :

Sensory neurons which are sensitive to chemicals , called chemoreceptors are also responsible to determine rate and depth of respiration . Central chemoreceptors are located in or near medulla oblongata in central nervous system . They respond to changes in H^+ concentration in CSF . Peripheral chemoreceptors are located in the aortic bodies in clusters in the walls of aortic arch close to aortic baroreceptors and in carotid bodies in oval nodules in walls of left and right carotid arteries close to carotid sinus baroreceptors .These chemoreceptors are part of peripheral nervous system.
CO_2 is converted to HCO_3; most CO_2 produced at the tissue cells is carried to lungs in the form of HCO_3

- CO_2 & H_2O form carbonic acid (H_2CO_3)
- changes to H CO_3 & H+ ions
- result is H+ ions are buffered by plasma proteins

Respiratory System :

The respiratory system is divided in to the upper and lower respiratory tracts:

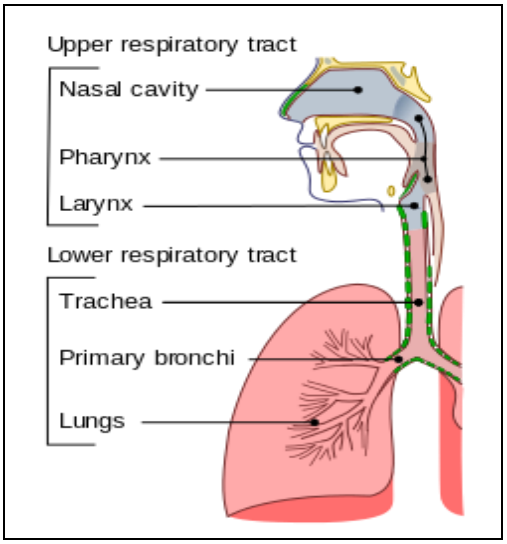
Upper Respiratory Tract :

The upper respiratory tract consists of the nose and the pharynx. Its primary function is to receive the air from the external environment and filter, warm, and humidify it before it reaches the delicate lungs where gas exchange will occur.

Lower Respiratory Tract :

The lower respiratory tract starts with the larynx, and includes the trachea, the two bronchi that branch from the trachea, and the lungs themselves. This is where gas exchange actually takes place.

Respiratory Tract : 1) Larynx - Figure [6]

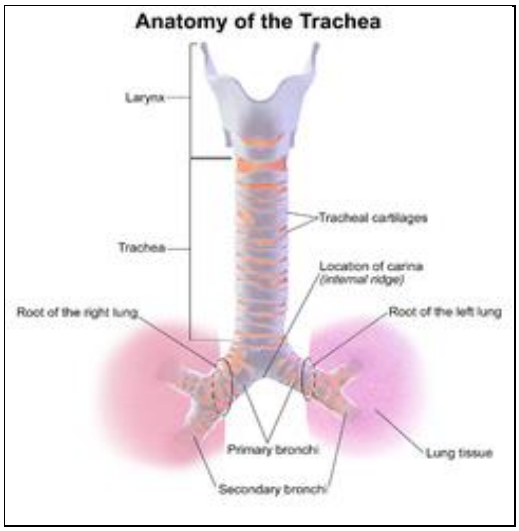


The larynx houses the vocal cords, and is situated just below where the tract of the pharynx splits into the trachea and the oesophagus. The larynx contains two important structures: the epiglottis and the vocal cords.

The epiglottis is a flap of cartilage located at the opening to the larynx . During swallowing , the larynx (at the epiglottis and at the glottis) closes to prevent swallowed material from entering the lungs .

The vocal cords consist of two folds of connective tissue that stretch and vibrate when air passes through them, causing vocalization.

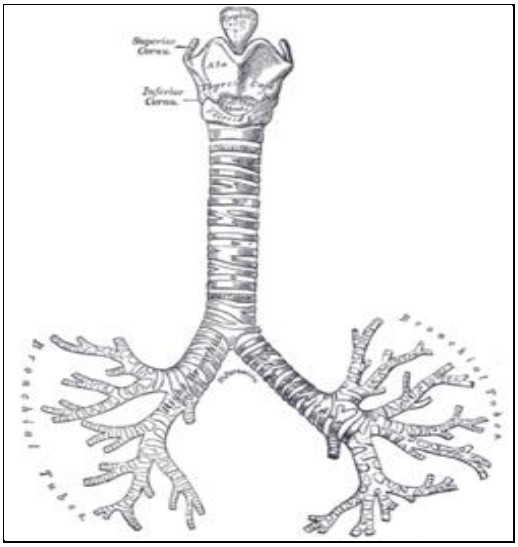
2) Trachea - Figure [7]



The trachea, is a tube having an inner diameter of about 25 millimetres (1 in) and a length of about 10 to 16 centimetres (4 to 6 in) that connects the pharynx and larynx to the lungs,

allowing the passage of air . There are from fifteen to twenty incomplete C-shaped tracheal rings of cartilage that reinforce the front and sides of the trachea to protect and maintain the airway. Circular bands of fibrous connective tissue called the annular ligaments of trachea join the tracheal rings together. The trachea is lined with pseudostratified columnar epithelium a type of epithelium with goblet cells that produce mucins the main component of mucus, to moisten and protect the airways.

3) Bronchi - Figure [8]



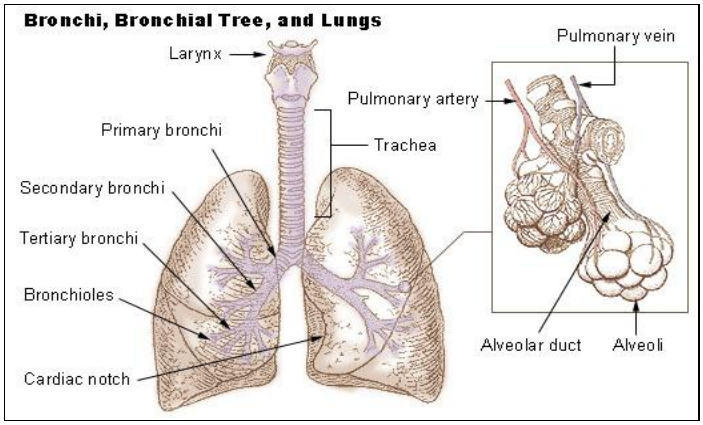
A bronchus, also known as a main or primary bronchus, is a passage of airway in the respiratory tract that conducts air into the lungs. There is a right bronchus and a left bronchus and these bronchi branch into smaller secondary and tertiary bronchi which branch into smaller tubes, known as bronchioles. No gas exchange takes place in the bronchi.

There are five or six alveolar sacs associated with each alveolar duct. The alveolus is the basic anatomical unit of gas exchange in the lung.

Asthma is hyperreactivity of the bronchi with an inflammatory component, often in response to allergens.

In asthma, the constriction of the bronchi can result in a difficulty in breathing giving shortness of breath; this can lead to a lack of oxygen reaching the body for cellular processes. In this case an asthma puffer can be used to rectify the problem. The puffer administers a bronchodilator, which serves to soothe the constricted bronchi and to re-expand the airways. This effect occurs quite quickly.

4) Lungs – Figure [9]

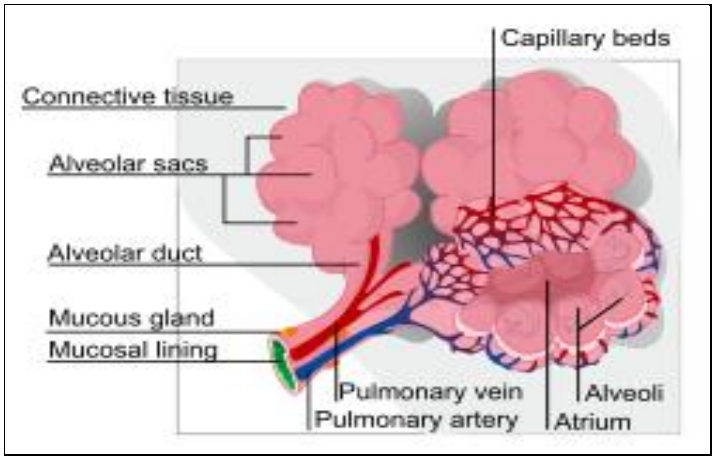


The human lungs are the organs of respiration . Humans have two lungs, a right lung and a left lung. The right lung consists of three lobes while the left lung is slightly smaller consisting of only two lobes . Together, the lungs contain approximately 2,400 kilometers of airways and 300 to 500 million alveoli.

Structure :

The lungs are located within the thoracic cavity, on either side of the heart and close to the backbone. They are enclosed and protected by the ribcage . The left lung has a lateral indentation which is shaped to accommodate the position of the heart. The right lung is a little shorter than the left lung and this is to accommodate the positioning of the liver. Both lungs have broad bases enabling them to rest on the diaphragm without causing displacement. Each lung near to the centre has a recessed region called the hilum which is the entry point for the root of the lung. The bronchi and pulmonary vessels extend from the heart and the trachea to connect each lung by way of the root .

5) **Alveoli :** Pulmonary alveolus - **Figure [10]**



An **alveolus** (plural: **alveoli**, from Latin *alveolus*, "little cavity") is an anatomical structure that has the form of a hollow cavity. The pulmonary alveoli are the terminal ends of the respiratory tree, which outcrop from either alveolar sacs or alveolar ducts, which are both sites of gas exchange with the blood as well. The alveolar membrane is the gas-exchange surface. Carbon dioxide rich blood is pumped from the rest of the body into the alveolar blood vessels where, through diffusion, it releases its carbon dioxide and absorbs oxygen . They provide total surface area of about 100 m^2. A typical pair of human lungs contain about 700 million alveoli, producing 70m^2 of surface area. Each alveolus is wrapped in a fine mesh of capillaries covering about 70% of its area .

The alveoli consist of an epithelial layer and extracellular matrix surrounded by capillaries . The alveoli contain some collagen and elastic fibres which allow the alveoli to stretch as they are filled with air during inhalation. They then spring back during exhalation in order to expel the carbon dioxide-rich air .

Histology :

There are three major cell types in the alveolar wall (pneumocytes):

1) Type I (Squamous Alveolar) cells that form the structure of an alveolar wall

2) Type II (Great Alveolar) cells that secrete pulmonary surfactant to lower the surface tension of water and allows the membrane to separate, therefore increasing its capability to exchange gases.

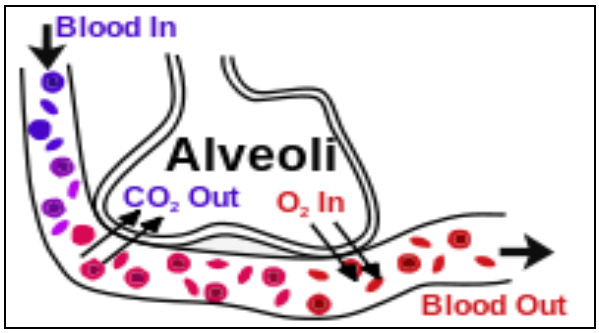
3) Macrophages that destroy foreign material, such as bacteria.

In asthma, the bronchioles, or the "bottle-necks" into the sac are restricted, causing the amount of air flow into the lungs to be greatly reduced. It can be triggered by irritants in the air, photochemical smog for example, as well as substances that a person is allergic to.

Homeostasis and Gas Exchange :

Homeostasis is maintained by the respiratory system in two ways: gas exchange and regulation of blood pH.

Gas Exchange - Figure [11]



Gas exchange in the lungs and in the alveoli is between the alveolar air and the blood in the pulmonary capillaries. This exchange is a result of increased concentration of oxygen, and a decrease of C02. This process of exchange is done through diffusion.

External Respiration :

External respiration is the exchange of gas between the air in the alveoli and the blood within the pulmonary capillaries. A normal rate of respiration is 12-25 breaths per minute.

In external respiration, gases diffuse in either direction across the walls of the alveoli. Oxygen diffuses from the air into the blood and carbon dioxide diffuses out of the blood into the air.

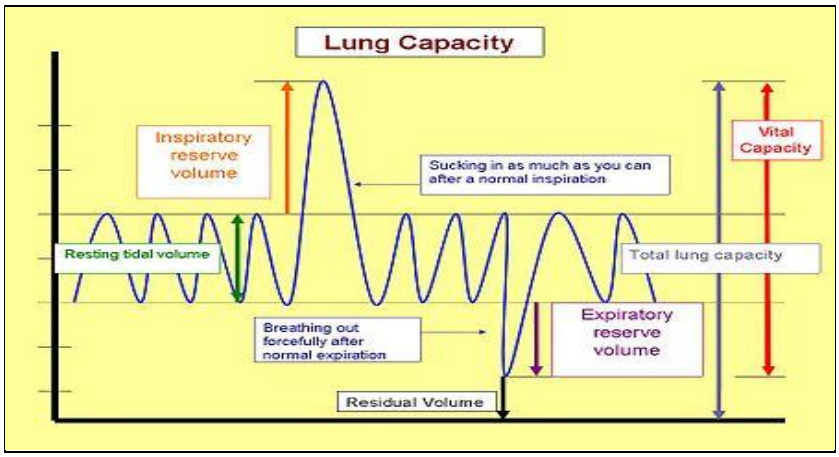
Internal Respiration :

Internal respiration is the exchanging of gases at the cellular level.

Cellular Respiration :

Cellular respiration is the process of moving energy from one chemical form (glucose) into another (ATP), since all cells use ATP for all metabolic reactions .It is in the mitochondria of the cells where oxygen is actually consumed and carbon dioxide produced. As cells take apart the carbon molecules from glucose, these get released as carbon dioxide . Each body cell releases carbon dioxide into nearby capillaries by diffusion, because the level of carbon dioxide is higher in the body cells than in the blood. In the capillaries, some of the carbon dioxide is dissolved in plasma and some is taken by the haemoglobin , but most enters the red blood cells where it binds with water to form carbonic acid . It travels to the capillaries surrounding the lung where a water molecule leaves, causing it to turn back into carbon dioxide. It then enters the lungs where it is exhaled into the atmosphere .

Lung Capacity – Figure [12]



The normal volume moved in or out of the lungs during quiet breathing is called **Tidal volume i.e. about 500 Ml .** Breathing in very deeply is **Inspiratory Reserve Volume** increased lung volume by **2900 mL**, which is quite a bit more than the tidal volume of 500 mL. Increase expiration by contracting our thoracic and abdominal muscles is called **Expiratory Reserve Volume** and is about **1400 ml of air**.

Vital capacity is the total of tidal, inspiratory reserve and expiratory reserve volumes; it is called vital capacity because it is vital for life . There are a number of illnesses that decrease vital capacity.

Stimulation of Breathing

There are two pathways of motor neuron stimulation of the respiratory muscles. The first is the control of voluntary breathing by the cerebral cortex . The second is involuntary breathing controlled by the medulla oblongata.

Regulation of Blood pH

Maintaining the acid/base balance of our blood is vital to our survival. Normal blood pH is set at 7.4, which is slightly alkaline or "basic". There are three factors in this process: the lungs, the kidneys and buffers.

Exactly speaking pH is the concentration of hydrogen ions (H+). Buffers are molecules which take in or release ions in order to maintain the H+ ion concentration at a certain level. The most important buffer we have in our bodies is a mixture of carbon dioxide (CO2) and bicarbonate ion (HCO3). **Bicarbonate Buffer System**. With this important system our bodies maintain homeostasis. (Note that H2CO3 is Carbonic Acid and HCO3 is Bicarbonate)

CO2 + H2O <---> H2CO3 <---> (H+) + HCO3

- If pH is too high, carbonic acid will donate hydrogen ions (H+) and pH will drop.
- If pH is too low, bicarbonate will bond with hydrogen ions (H+) and pH will rise.

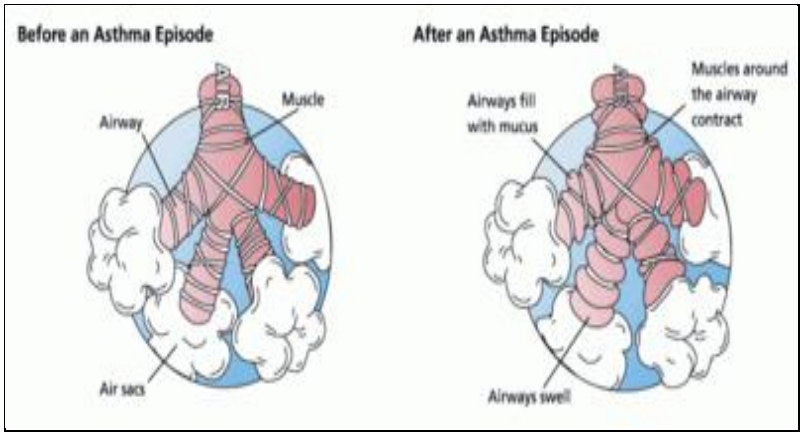
Too much CO2 or too little HCO3 in the blood will cause acidosis by ketoacidosis , a condition caused by excess fat metabolism (diabetes mellitus).

Too much HCO3 or too little CO2 in the blood will cause alkalosis , condition less common than acidosis. CO2 can be lowered by hyperventilation.

Lower Respiratory Tract Disorders

Asthma comes in Lower Respiratory Tract Disorder in category of restrictive pulmonary disorder .

Diagram of the lungs during an asthma attack - Figure [13]



Asthma is a respiratory disease of the bronchi and bronchioles. The symptoms include wheezing, shortness of breath, and sometimes a cough that will expel mucus. The airways are very sensitive to irritants which can include pollen, dust, animal dander, and tobacco. Even being out in cold air can be an irritant. When exposed to an irritant, the smooth muscle in the bronchioles undergoes spasms. Most asthma patients have at least some degree of bronchial inflammation that reduces the diameter of the airways and contributes to the seriousness of the attack.

REFERENCE :

1)Principles of Anatomy and Physiology , Eleventh Edition , by Gerard Tortora & Bryan Derrickson , John Wiley and sons Inc.

Tamakashwasa

As definition and diagnostic criteria of *Tamakashwasa* , following aphorisms are given in *Charak Samhita* , which give information about *Hetu* (Aetiopathological factors) , *Samprapti* (chain of events in pathophysiology) and *Lakshana* (symptomatology) of *Tamakashwasa*.

1) *प्रतिलोमं यदा वायु□स्त्रोतांसि प्रतिपद्यते □*

ग्रीवाशिरश्च संगृह्य श्लेष्माणं समुदीर्य च □□

करोति पीनसं तेन □द्धो घुर्घुरकं तथा □

अतीवतीव्रवेगं च □वासं प्राणप्रपीडकम् □□

प्रताम्यति वेगाच्च कासते सन्नि□ध्यते □

प्रमोहं कासमानश्च स गच्छति मुहुर्मुहु□□□

श्लेष्मण्यमुच्यमाने तु भृशं भवति दु□□ित□□

तस्यैव च विमोक्षान्ते मुहूर्त लभते सुखम् □□

अथास्योध्वंसते कण्ठ□कृच्छ्राच्छक्नोति भाषितुम् □

न चापि निद्रां लभते शयान□श्वासपीडित□□□

पार्श्वे तस्य अवगृह्णाति शयानस्य समीरण□□

आसीनो लभते सौख्यंमुष्णं चैवाभिनन्दति □□

उच्छ्रिताक्षो ललाटेन स्विद्यता भृशमर्तिमान □

विशुष्कास्यो मुहु□श्वासो मुहुश्चैवावधम्यते □□

मेघाम्बुशीतप्रावातै□श्लेष्मलैश्चाभिवर्धते □

स याप्यस्तमकश्वास□साध्यो वा स्या□□ोत्थित□ □□

इति तमकश्वास□ [1]

Vayu moving in reverse order pervades the channels (of vital breath) ,afflicts the neck and head ,and stimulates phlegm to cause rhinitis . This *Vayu* ,thus obstructed , produces the following signs and symptoms :

Ghurghuraka - wheezing sound or murmuring sound.

Dyspnoea of exceedingly deep velocity which is life threatening.

Because of acute spasms ,the patient gets tremors and coughs , become static.

He faints while coughing.

Since the phlegm does not come out (drained properly) , he becomes restless.

He is relieved sometime when phlegm comes out.

His throat is choked and he is unable to speak freely.

He is unable to sleep, as he gets dyspnoea while lying down for sleep because the sides of chest get afflicted by *Vayu* but he is relieved in sitting posture.

He craves or likes hot comfort.

Eyeballs project out side.

Sweating on forehead and becomes restless.

His mouth becomes dry.

He gets frequent paroxysms dyspnoea.

Attack get aggravated when sky is cloudy ,when exposed to cold water or humidity , exposed to easterly breezes and when he resorts to *kapha* aggravating food and regimen.

This disease *Tamakashwasa* is generally palliative , & it is curable only in primary stage .

2) Following is the aphorism from *Sushrut Samhita*

विहाय प्रकृतिं वायु: प्राणोऽथ कफसंयुत : □

श्वासयत्यूर्ध्वगो भूत्वा तं श्वासं परिचक्षते [illegible]

प्रागूपं तस्य हृत्पीडा भक्तद्वेषोऽरति: परा □

आनाह: पार्श्वयो: शूलं वैरस्यं वदनस्य च [illegible]

तृट्स्वेदवमथुप्राय: कण्ठघुर्घुरिकान्वित: □

विशेषाहुर्दिने ताम्येच्छवास: स तमको मत: [illegible]

घोषेण महताऽऽविष्ट: सकास: सकफो नर: □

य: श्वसित्यबलोऽ[illegible]ट् सुप्तस्तमकपीडित: [illegible]

स शाम्यति कफे हीने स्वपतश्च विवर्धते □

मूर्च्छाज्वराभिभूतस्य ज्ञेय: प्रतमकस्तु स: [illegible] सुश्रुतसंहिता उत्तरतंत्र ५१ /४, ६, ८, ९, १० [2]

3) Following aphorisms are quoted from **4th chapter of 3rd section (*Nidaansthana)* of *Ashtang Hriday* :**

कासवृध्दया भवेत् श्वास□पूर्वैर्वा दोषकोपनै□□

आमातिसारवमथुविषपाण्डुज्वरैरपि □

रजोधूमानिलैर्मर्मघातादतिहिमाम्बुना □

अष्टांगहृदय निदानस्थान अध्याय ४ सूत्र १□ [3]

Shwasa arises from increased cough or by the causes which bring about aggravations of the *Doshas* , also by diarrhoea , indigestion ,vomiting ,by poisons , anaemia , fever , exposure to dust , smoke and breeze , injury to vital organs and drinking very cold water .

4) *कफोप□द्धगमन□पवनो विष्वगास्थित□□*

प्राणोदका□वाहिनी दुष्ट□स्रोतांसि दूषयन् □

उरस्थ□कु□ती श्वासं आमाशयसमुद्भवम् □

अष्टांगहृदय निदानस्थान अध्याय ४ सूत्र ३□ [4]

Vata gets obstructed in its movement by *kapha* , this obstruction spreading in all directions , vitiates the channels of *Prana* (respiration) ,*Udaka* (water) and *Anna* (food) located in and around the chest and produces *shwasa* which arises from *Amashay* (stomach).

5) *प्रतिलोमंसिरागच्छ□द्वीर्य पवन कफम् □*

परिगृह्य शिरोग्रीवमुर□पार्श्वे च पीडयन् □

कासं घुर्घुरक मोहम□घिं पीनसं तृषम् □

करोति तीव्रवेगं च श्वासं प्राणोपतापिनम् □

प्रताम्येत्तस्य वेगेन निष्टयूतान्ते क्षणं सुखी □

कृच्छ्राच्छ्वसिति निषण्ण□श्वास्थ्यमृच्छति □□

उच्छ्रिताक्षो ललाटेन स्विद्यता भृशमार्तिमान् □

विशुष्कास्यो मुहु□श्वासी काङक्षत्युष्णं सवेपथु□□

मेघाम्बुशीतप्राग्वातै□ श्लेष्मलैश्च विवर्धते □

स याप्यस्तमक□साध्यो नवो वा बलिनो भवेत् □□ अष्टांगहृदय निदानस्थान अध्याय ४ सूत्र ६□७□८□९

[5]

Aggravated *Vata* moves in upward direction (*srotas* or channels in respiratory system) ,also aggravates *Kapha* and produces *shwasa* (dyspnoea due to bronchial spasm) ,with catching pain in head and neck ,delusion , loss of taste and appetite , cough with cracking sound ,running nose , thirst , respiration is forceful producing great distress to life , loses consciousness about surroundings , expectoration of cough gives momentary comfort , while lying down unable to breathe but finds comfortable while sitting ,eyes are wide open gazing up , forehead sweating , mouth is dry ,frequent bouts of dyspnoea ,desires hot comfort , tremors , all these symptoms aggravate by cloudy sky , direct breeze , ingestion of food increasing *kapha* .

This is called as *Tamakshwasa* which is a chronic condition only curable if the onset is recent and if the patient is strong. [6]

Another dissertation for M.D. on topic "*Tamakshwasa"* - "An Aetiopathological study of *Tamakshwasa*" - Doctor of Medicine *Kayachikitsa (Vikruti Vidnyan)* By Dr Anand Kelaskar , under guidance of Dr. B.N. Upadhyay , HOD , Department of Kayachikitsa , Faculty of Ayurveda Institute of Medical Sciences , Banaras Hindu University, Varanasi 221005 ,December 1998.

This discusses *Tamakshwasa* in detail in modern parlance.

So this thesis work was done to see whether any interpretation can be established about *Mahasrotas* which is *moolsthana* of *Pranavaha srotas* in condition of *Tamakashwasa* which is disease of *Pranavaha Srotas* .

6) वैवर्ण्यमूर्च्छाज्वरकासहिक्का श्वासास्यवैरस्यतृषाप्रमोहा□□
छर्दि□क्रफोत्क्लेश□ोऽ□विश्च हृद्रोगजा□ःयुर्विविधास्तथाऽन्ये □७८□
चरक सं.चि□२६क्र ७८

Acharya Charak has described **कास** and **श्वास** among the cardinal symptoms of हृद्रोग **. [7]**

7) गुल्महृद्रोगसंमोहा□श्रमनि□श्वासधारणात् □चरक सूत्र□७क्र२४

Holding श्रमश्वास or नि□श्वास are causes of हृद्रोग . **[8]**

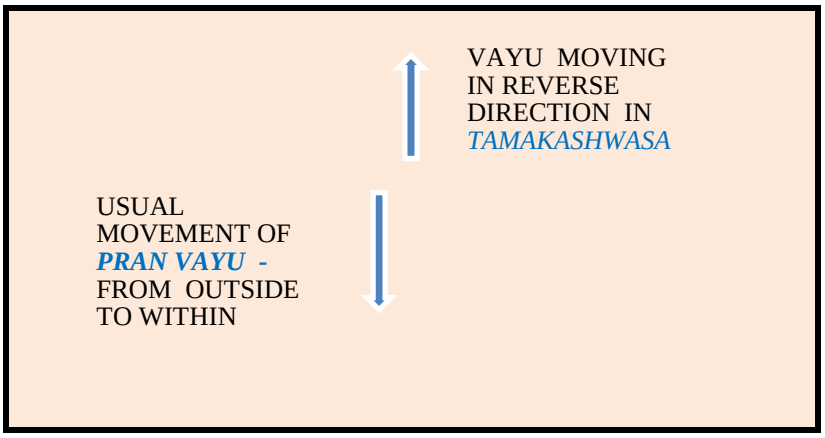
8) वातविण्मूत्रजृम्भाश्रुक्षवोद्गारवमीन्द्रियै □
क्षुत्तृष्णोच्छ्वसनिद्राणांधृत्योदावर्तसंभव□□मुश्रुत उ□५क्र४

उदभूतेन वेगविधारणेनाऽवृत्तस्य वायोर्वर्तनमित्युदावर्तनि□क्ति□□सा□नि □

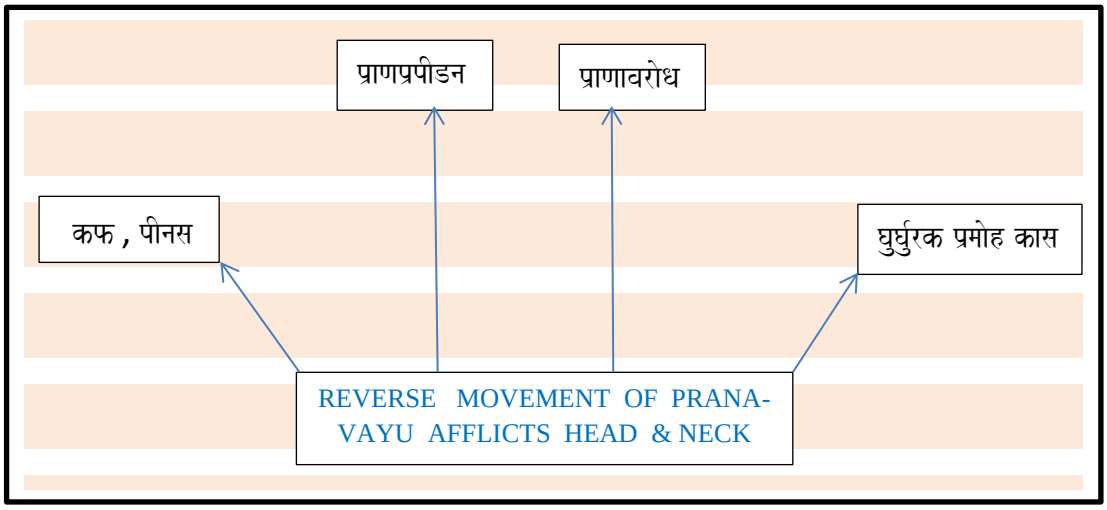
श्रान्तस्य नि□श्वासविनिग्रहेण हृद्रोगमोहावथाऽपि गुल्म□□सुश्रुत उ□५८क्र१७

Holding श्रमश्वास is one reason of हृद्रोग . **[9]**

Flow chart [1] *TAMAKASHWASA SAMPRAPTI* :



Flow chart [2] *TAMAKASHWASA LAKSHANA*



In the context to the concerned thesis work *Tamakashwasa* has been interpreted as Bronchial Asthma .

As definition and diagnostic criteria of *Tamakashwasa* , aphorisms from *Charak Samhita* gives information about *Hetu* (Aetiopathological factors) , *Poorvaroop* (prodromal symptoms) , *Roop* (Symptomatology) , *Upashaya* (Exploratory Therapy or methods) and *Samprapti* (chain of events in pathophysiology) of *Tamakashwasa* .

***Vayu* moving in reverse order pervades the channels (of vital breath) , afflicts the neck and head , and stimulates phlegm to cause rhinitis . This *Vayu* , thus obstructed , produces the signs and symptoms .**

Aphorisms from 4th chapter of 3rd section (*Nidaansthana)* of *Ashtang Hriday* describes *Shwasa a*rising from increased cough or by the causes which bring about aggravations of the *Doshas* , also by diarrhoea , indigestion ,vomiting ,by poisons , anaemia , fever , exposure to dust , smoke and breeze , injury to vital organs and drinking very cold water .

According to aphorisms in *Ashtanghriday Nidansthana* chapter 4/ *sutra* 3-10 *Vata* gets obstructed in its movement by *Kapha* , this obstruction spreading in all directions , vitiates the channels of *Prana* (respiration) , *Udaka* (water) and *Anna* (food) located in and around the chest and produces *Shwasa* which arises from *Amashay* (stomach).

***Tamakshwasa* which is a chronic condition only curable if the onset is recent and if the patient is strong . This condition is called Bronchial asthma in modern parlance.**

Another dissertation for M.D. on topic "*Tamakshwasa"*-"An Aetiopathological study of *Tamakshwasa*" - Doctor of Medicine *Kayachikitsa (Vikruti Vidnyan)* By Dr Anand Kelaskar , under guidance of Dr. B.N. Upadhyay , HOD , Department of Kayachikitsa , Faculty of Ayurveda Institute of Medical Sciences , Banaras Hindu University, Varanasi 221005 , December1998

This discusses *Tamakshwasa* in detail depicting it's interpretation as Bronchial asthma in modern parlance.

So we can conclude from all abovementioned references and discussions that *Tamakashwasa* can be interpreted as Bronchial Asthma in modern terminology .

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Bronchial Asthma

Bronchial Asthma in Modern Medicine :

Bronchial Asthma prevalence :

According to the latest information of WHO India has estimated 15-20 million asthmatics . Asthma is largely avoidable , asthma tends to occur in epidemics and affects young people in age group of 15-34 yrs. though variability seen based on occupation , education , and socio-economic status .

Human and economic burden associated with this condition is severe . Worldwide the economic costs associated with asthma are estimated to exceed those of TB and HIV/AIDS combined . [1],[2]

Asthma attacks all age groups but often starts in childhood . Approximately one third to one half of asthma cases in population are attributed to atopy . A positive relationship between asthma in family members and development of airway hyper-responsiveness or asthma is well recognised .

WHO recognises asthma as a disease of major public health importance and stimulating research into the causes of asthma to develop new control strategies and treatment techniques . WHO is developing strategy for prevention of Bronchial asthma through the management of allergic rhinitis .

It is characterised by recurrent attacks by breathlessness and wheezing which vary in intensity and frequency from person to person .

Asthma is due to the inflammation of air passages in the lungs and affects the sensitivity of nerve endings in the airways so they get easily irritated . During recurrent asthmatic attacks , lining of the air passages swell causing the airway narrow and reducing the flow of air in and out of the lungs .

Asthma can't be cured but controlled . Strongest risk factors for developing asthma are exposure to indoor allergens like mites in bedding , stuffed furniture etc. , cockroaches , cats and having family history of asthma and allergy .

Exposure to tobacco smoke and irritant chemicals are added risk factors . Certain drugs like aspirin , NSAIDs , low birth weight , respiratory infections are also added risk factors . The weather (cold air) , extreme emotional expression and physical exercise can exacerbate asthma .

Urbanisation can be correlated with an increase in prevalence of Asthma . On and average worldwide prevalence rate of asthma is increasing by 50% in a decade .

Asthma is thought to be caused by combination of genetic and environmental

factors . It's diagnosis is usually based on the pattern of symptoms , response to therapy and spirometry . Clinically it is classified according to frequency of symptoms , forced expiratory volume in one second (FEV1) and Peak Expiratory Flowrate .

Asthma is a complex disorder characterised by intermittent , reversible airway obstruction , and by airway hyper-responsiveness and inflammation .

Although it's causes remain unknown ,we now recognise that asthma is a syndrome , who's common pathologic expression is inflammation of the airways .The airways of the patients even with mild asthma are inflamed, and severity of asthma parallels the degree of inflammation .

Asthma is an airway disease that can be classified physiologically as a variable and partially reversible obstruction to airflow , and pathologically with over developed mucus glands ,airway thickening due to scarring and inflammation and bronco-constriction , the narrowing of the airways in the lungs due to the tightening of surrounding smooth muscles .

Bronchial inflammation also causes narrowing due to oedema and swelling caused by an immune response to allergens .

During an asthmatic episode , inflamed airways react to environmental triggers (sensitising agents) such as smoke , dust or pollens .The airways narrow and produce excess mucus , making it difficult to breathe . In essence asthma is the result of an immune response in bronchial airways .

The airways of asthma patients are 'hypersensitive' to certain triggers , also known as stimuli . Trigger or stimuli can be any household pets , air pollution , organic compounds , medication (aspirin , β adrenergic blocking drugs) , penicillin , food allergens (milk , eggs , peanuts) , toxic gases , early childhood URT infection , exercise , hormonal imbalance , stress etc.

Etiopathogenesis & Types :

Based on the stimuli initiated bronchial asthma ,two broad etiologic types are traditionally described :

1) Extrinsic (atopic / allergic) - Most common type of asthma .

Usually begins with childhood or in early adulthood . Most patients of this group have personal /family history of preceding allergic diseases such as rhinitis , urticaria , infantile eczema etc.

Antigenic substances or allergens are usually present in these cases . Most of these allergens cause ill effects by inhalation eg. House dust, pollens , animal dander , moulds etc.

Occupational asthma stimulated by fumes , gases, organic and chemical dust is a variant of extrinsic asthma.

There are increased levels of IgE in serum and positive skin test with specific offending allergen representing an IgE mediated type I hypersensitivity reaction which includes acute immediate response and late phase reaction .

This form of asthma is believed to be driven by the TH2 subset of CD4+ T cells .

The acute immediate response : is initiated by IgE sensitised Mast cells (tissue counterparts of circulating basophils) on the mucosal surface .

Mast cells on degranulation release mediators like histamine , leukotrienes , prostaglandins , platelet activating factor and chemotactic factors for eosinophils and neutrophils . The net effect of these mediators are bronchoconstriction , oedema , mucus hypersecretion and accumulation of eosinophils and neutrophils .

Late phase reaction : follows the acute immediate reaction and is responsible for prolonged manifestations of asthma .

It is caused by mobilisation of blood leucocytes , that include basophils besides eosinophils and neutrophils .These results further release of mediators which accentuate the above mentioned effects . Inflammatory injury is caused by neutrophils and Major basic proteins .

2)Intrinsic (idiosyncratic /non-atopic)

This type of asthma develops in later adult life with negative personal and family history , negative skin test and normal serum IgE levels .

Most patients develop typical symptoms after an upper respiratory tract infections by viruses . There are no recognisable allergens but few patients may be allergic to certain triggering factors . Triggering mechanisms are non-immune. In this form , a number of stimuli that have little or no effect in normal subjects can trigger bronchospasm . Such factors include aspirin; pulmonary infections especially caused by viruses ; cold , psychological stress ; exercise , and inhaled irritants such as ozone and sulphur dioxide . Associated nasal polyps and chronic bronchitis is commonly present .

3)Mixed type :

Many patients do not clearly fit into either of above mentioned categories and have mix features of both. Those patients who develop asthma in early life have strong

allergic component , while those who develop disease late tend to be non-allergic. Either type of asthma can be precipitated by cold, exercise and emotional stress .

Like all type I hypersensitivity reactions , extrinsic asthma is driven by sensitization of CD4+ cells of the type TH2 type .These cells release cytokines specifically interleukin IL4, IL5, IL13 , which favour the synthesis of IgE , growth of mast cells ,and growth and activation of eosinophils . Induction of the TH2 response is fundamental to the pathogenesis of allergic asthma , and IgE , mast cells and eosinophils are key players in mediating it .

Early phase mediators include :

1) Leukotrienes C4, D4,E4 : extremely potent mediators that cause prolonged bronchoconstriction , increase vascular permeability , and increase mucin secretion .

2) Prostaglandins D2,E2,F_{2a} elicit bronchoconstriction and vasodilation .

3) Histamine : causes bronchospasm and increase vascular permeability .

4) Platelet activating factor : causes aggregation of platelets and release of histamine from their granules .

5) Mast cells tryptase : inactivates bronchodilatory peptide (vasoactive intestinal peptide) [3]

Pathologic changes :

The common denominator underlying in all types of asthma is an exaggerated Broncho constrictor response (airway hyper-responsiveness) to variety of stimuli .

Persistent inflammation of bronchi ,manifested by the presence of inflammatory cells (esp.eosinophils , mast cells and lymphocytes) and by damage to bronchial epithelium , is the constant feature of bronchial asthma.

The pathologic changes are similar in both major types of asthma .

Microscopically following changes are observed :

1) The mucus plugs contain normal and degenerated respiratory epithelium forming twisted strips called Curschmann's spirals .

2) The sputum usually contain numerous eosinophils and diamond shaped crystals called Charcot- Leyden crystals

3) Bronchial wall shows thickened basement membrane of bronchial epithelium , submucosal oedema and inflammatory exudate consisting of lymphocyte and plasma

cells with prominence of eosinophils . There is hypertrophy of submucosal glands and bronchial smooth muscles .

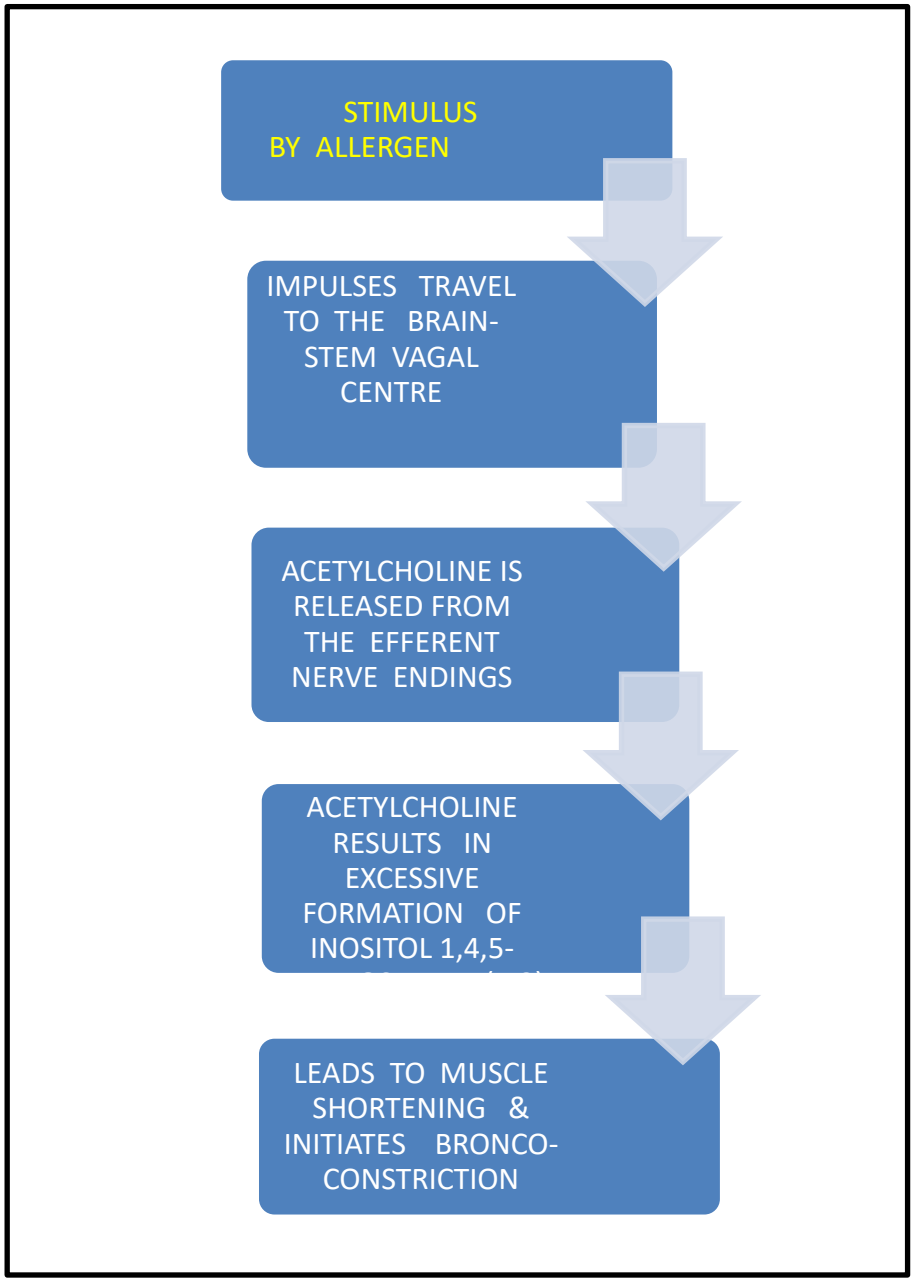
4) Changes of bronchitis and emphysema ,especially in Intrinsic asthma .

Clinical Features :

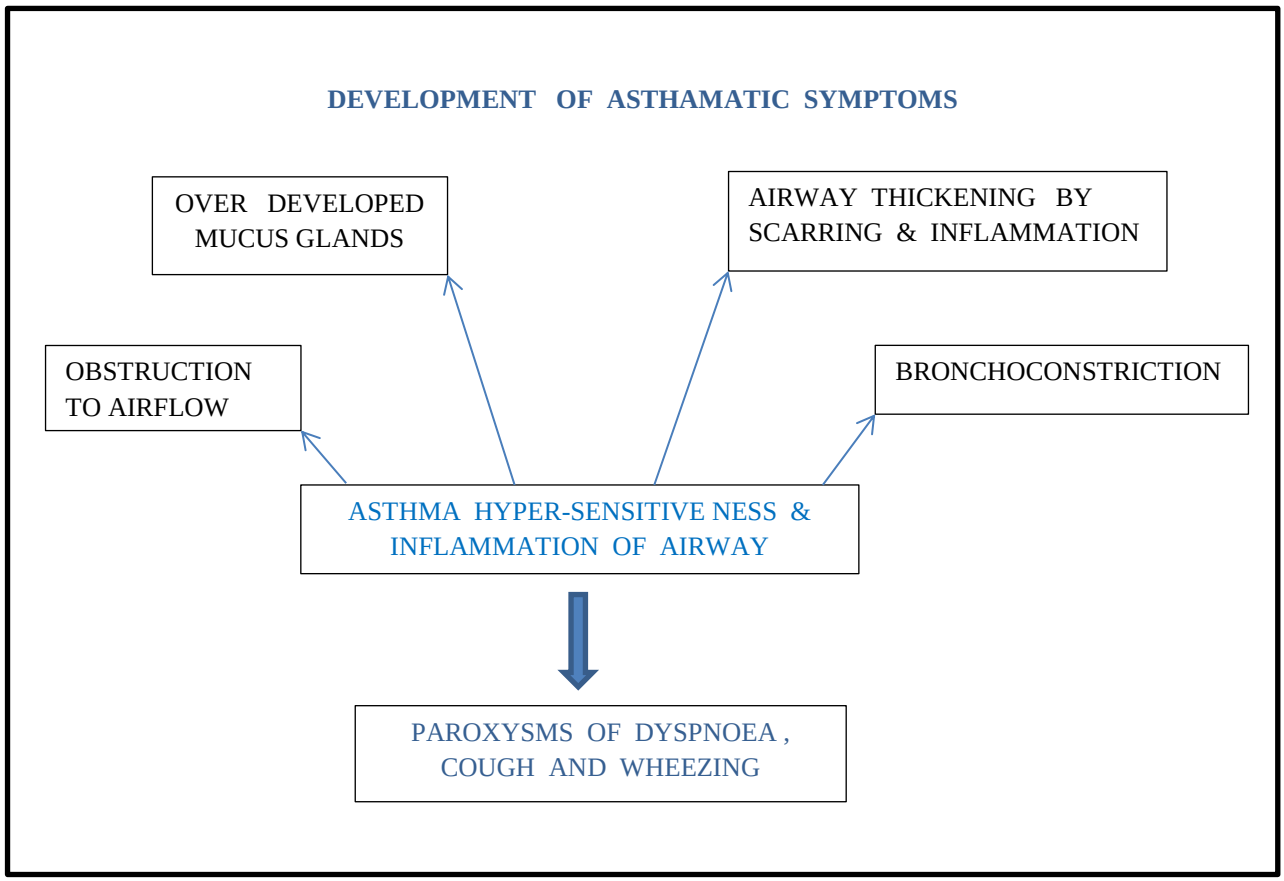
Asthmatic patients suffer from episode of acute exacerbations interspersed with symptomfree periods . Characteristic features are paroxysms of dyspnoea ,cough and wheezing . Most of the attacks last for few minutes to hours . [4]

Flow chart [3]

PHYSIOLOGICAL PATHWAY OF ALLEGIC REACTION IN BRONCHI



Flow chart [4]


DEVELOPMENT OF ASTHAMATIC SYMPTOMS
OVER DEVELOPED MUCUS GLANDS
AIRWAY THICKENING BY SCARRING & INFLAMMATION
OBSTRUCTION TO AIRFLOW
BRONCHOCONSTRICTION
ASTHMA HYPER-SENSITIVE NESS & INFLAMMATION OF AIRWAY
PAROXYSMS OF DYSPNOEA , COUGH AND WHEEZING

REFERENCE :

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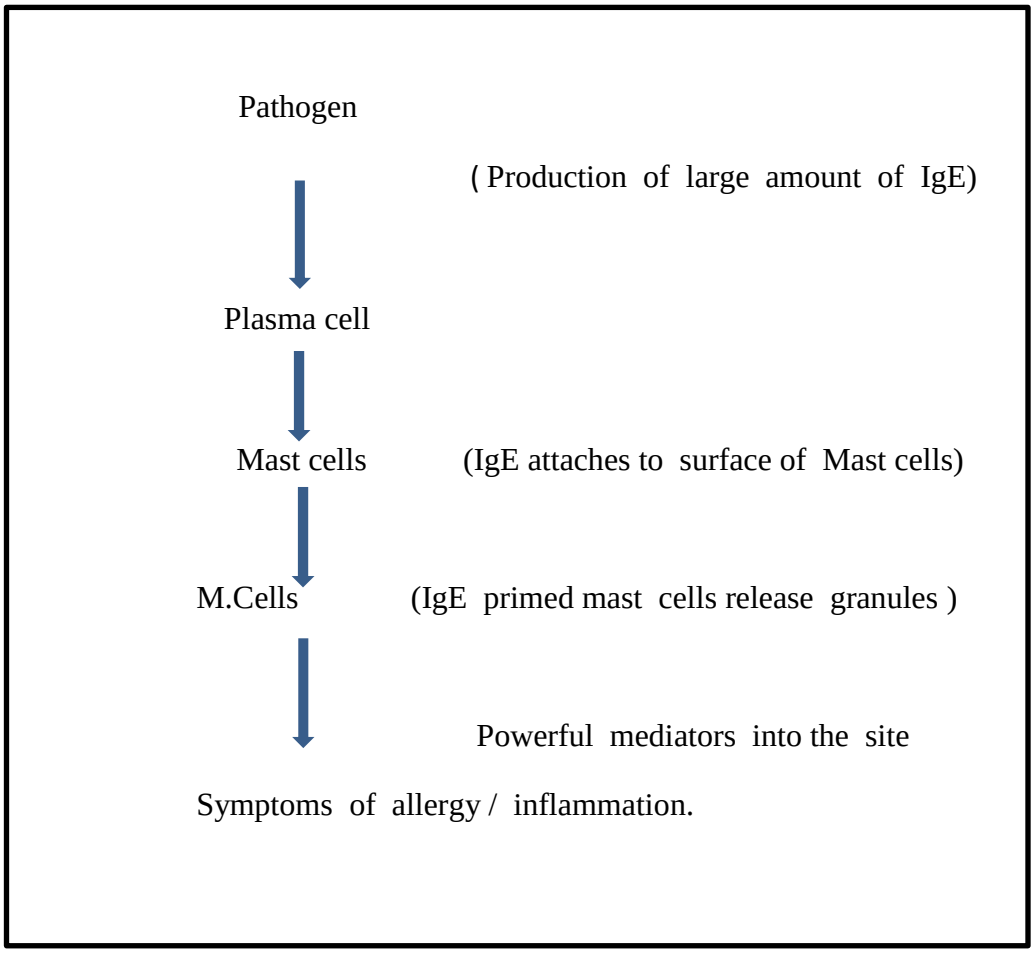
IMMUNO-BIOCHEMISTRY OF ASTHMA

Flowchart [5] Depicting Mechanisms behind Allergic Asthma :

Mechanisms involved - Allergen challenge leading to Airway Inflammation		
Infiltration of T lymphocytes ↓ Secretion of panel of cytokines ↓ Synthesis of IgE in microenvironment ↓ Mast cells priming & localising in mucosal/submucosal space ↓ Elaborate IL4 & IL5	Recruitment of mature Eosinophils ↓ In presence of Asthmatic cytokines convert to Auto aggressive Hypodense ↓ Hypodense increase amount of superoxide & Cysteine leukotrienes ↓ cytotoxic effect	Synthesis of IgE ↓ Binding of IgE ↓ Immunologically Sensitisation of Mast cells, Monocytes/Macrophages, Eosinophils , Basophils ↓ Elaboration of Inflammatory mediators (Histamine , leukotrines, Lipoxins,PAF,Protease) In microenvironment

Some studies suggest that Serotonin a neurotransmitter from Tryptophan family which is secreted by entero-chromaffin cells in the gut exert a major controlling effect on this immune-regulatory cascade in respiratory parenchyma .

Flowchart Diagram [6] Inflammatory Cascade



All these stimuli get impetus by immuno-regulatory focus of Serotonin .

Serotonin a neurotransmitter from Tryptophan family which is sercreted by enterochromaffin cells throughout the GI tract has a controlling key over the immuno-regulatory cascade in respiratory parenchyma .

This phenomenon strongly resembles the concept of *Mahasrotas* being *Moolsthana* of *Pranavaha srotas* proclaimed by *Acharya Charak* . To verify and validate this concept study design is generated to see whether there is any fluctuation in serum serotonin concentration in asthmatics in exacerbatory and non exacerbatory phases of Asthma and to infer whether any association exists between serotonin secretion in gut with inflammatory changes in respiratory system .

Micro Anatomy And Mechanisms Involved In Airway Inflammation

VARIOUS CELLS AND THEIR MECHANISMS INVOLVED IN AIRWAY INFLAMMATION

1.ALVEOLAR MACROPHAGE :

An alveolar macrophage (or dust cell) is a type of macrophage found in the pulmonary alveolus near the pneumocytes , but separated from the wall.

Activity of the alveolar macrophage is relatively high , because **they are located at one of the major boundaries between the body and outside world.**

Dust cells are monocyte derivatives , in the lungs that reside on respiratory surfaces and clean off particles such as dust or micro organisms .

Alveolar macrophages are phagocytes that play a critical role in homeostasis; host defence , the response to foreign substances and tissue remodelling.

Since **alveolar macrophages are pivotal regulators of local immunological homeostasis, their population density is decisive for the many processes of immunity in the lungs.**

Alveolar macrophages release numerous secretary products and interact with the other cells and molecules through the expression of several surface receptors.

To combat infection , **the phagocytes of the innate immune system facilitates many "Pattern Recognition Receptors (PRR)" to help recognize "Pathogen Associated Molecular Patterns (PAMPs)"on the pathogenic microorganism.**

Cytokines secreted by AMs –

1) Nitric Oxide – NO is a major of immunomodulator in the alveolar macrophage.

Prostaglandin endoperoxide 2 (PGE2)

2) PGE 2 is the first immune-modulator to be derived from macrophages

Transforming Growth Factor Beta (TGFbeta) - multifunctional cytokine that modulates a variety of biological processes such as cell growth apoptosis ,inflammation and immune responses.

2. MAST CELLS

Mast cell is derived from the myeloid stem cell. It is a part of the immune system and **contains many granules rich in histamine & heparin**.

These are well known for their role in allergy and anaphylaxis . Mast cells play important role in wound healing and defence against pathogens . **Mast cells reside in tissues eg. In mucosal tissues while basophils are found in the blood.**

Mast cells are present in most tissues characteristically surrounding blood vessels and nerves , specially prominent where inner body milieu comes in contact with outer atmosphere eg. Skin , lungs , mouth , conjunctiva , digestive system and nose.

Mast cells play key role in inflammatory process. When activated a mast cell rapidly releases its characteristic granules and various hormonal mediators into the interstitial part .

Mast cell granules carry a variety of bioactive chemicals and have fundamental role in 'innate immunity'. They are **capable of elaborating vast array of important cytokines and other inflammatory mediators .**

3. M CELL – MICROFOLD CELL

M cell or (micro fold cells) are cells found in the follicle associated epithelium of the Peyer's patches as well as in Bronchus Associated Lymphoid Tissue (BALT). They transport organisms and particles from the gut lumen to immune cells across the epithelial barrier and thus important in stimulating mucosal immunity.

They have the unique ability to take up antigen from the lumen of the small intestine via endocytosis or phagocytosis and then deliver it via transcytosis to dendritic cells (an antigen presenting cells) and lymphocytes (i.e. T cell) .

Structure & Function :

M cell , on their apical surface , **possess broader micro fold that give the cell it's name. M cell main function is the selective endocytosis of antigen and transporting them to intra epithelial macrophages & lymphocytes, which then migrate to lymph nodes where immune response is initiated.**

4. ENTEROCHROMAFFIN CELL

Entero Chromaffin (EC) cells or Kulchitsky cells are a **type of entero-endocrine and neuro-endocrine cells occurring in the epithelia lining the lumen of the digestive tract and the respiratory tract that release Serotonin.**

In human gastrointestinal tract the EC cells are distributed widely in the epithelium of stomach small intestine and colon.

They use the rate limiting enzymes tryptophan hydroxylase-1 (TPH1) to synthesise Serotonin and contain about 90% of the body's store of Serotonin (5 HT) [9]

Major Cytokines In Asthma

MAJOR CYTOKINES PLAYING ROLE IN ASTHMA :

1)Ig E

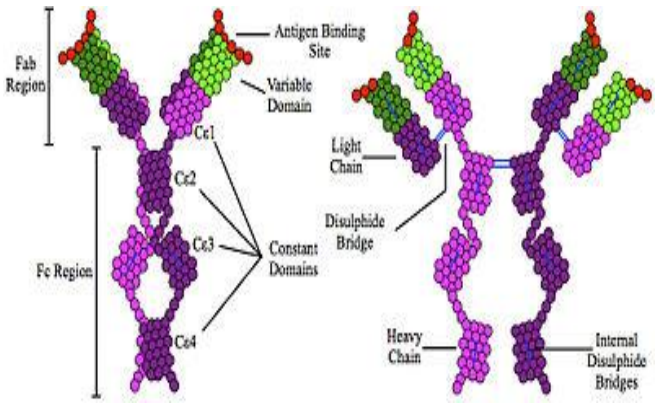
Immunoglobulin E (IgE) is a kind of antibody (or immunoglobulin Ig isotype) that has only been found in mammals. Monomers of IgE consist of two heavy chains (E chain) and two light chains.

IgE also has an essential role in type I hypersensitivity , which manifests various allergic diseases, such as allergic asthma, most types sinusitis , allergic rhinitis , food allergies and specific types of chronic urticaria and atopic dermatitis.

Role in Disease :

IgE can recognize specifically an 'Allergen' & has unique long lived interaction with it's high affinity so that basophils & mast cells , capable of mediating inflammatory reactions, become 'primed' to release chemicals like histamine , leucotrienes & certain interleukins. These chemicals cause many of the symptoms associated with allergy, such as airway constriction in asthma , local inflammation , increased mucus secretion and increased vascular permeability to allow other immune cells to gain access to tissues.

IgE structure : **Figure [14]**

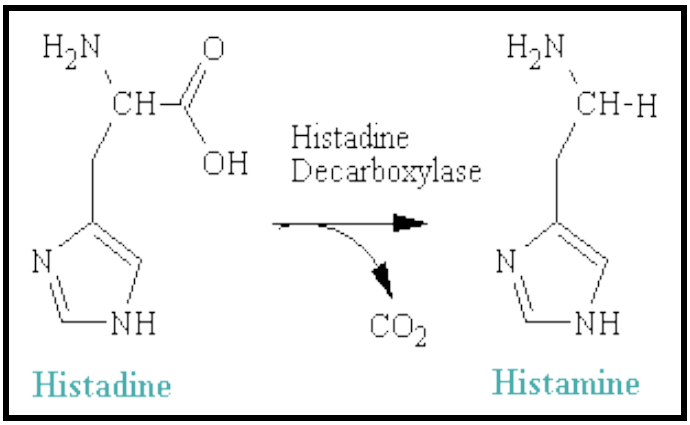


2) INTERLEUKINS : Interleukin are a group of cytokines (secreted proteins and signalling molecules) that **were first seen to be expressed by white blood cells (leukocytes) .** The function of the immune system depends in a large part on interleukins. The majority of interleukins are synthesised by helper CD4 T lymphocytes as well as through monocytes , macrophages and endothelial cells.

Table [2] - Interleukin functions :

Name of Interleukin	Major Source	Major Effects
IL-1	Macrophages	Stimulation of T cells & antigen-presenting cells. B-cell growth & antibody production. Promotes haematopoiesis (blood cell formation)
IL-2	Activated T cells	Proliferation of activated T cells.
IL-3	T Lymphocytes	Growth of blood cell precursors.
IL-4	T Cells and Mast Cell	B-cell proliferation , IgE production.
IL-5	T Cells and Mast Cell	Eosinophils growth
IL-6	Activated T Cells	Synergistic effects with IL-1 or TNF α
IL-7	Thymus and Bone Marrow Stromal Cells	Development of T cell & B cell precursors.
IL-8	Macrophages	Chemoattracts neutrophils.
IL-9	Activated T cells	Promotes growth of T cells & Mast cells
IL-10	Activated T Cells, B Cells and Monocytes	Inhibits inflammatory & Immune responses
IL-11	Stromal Cells	Synergistic effects on hematopoiesis
IL-12	Macrophages B Cells	Promotes TH 1 cells while suppressing TH 2 functions
IL-13	TH2Cells	Similar to IL-4 effects
IL-15	Epithelial Cells ,Monocytes	Similar to IL-2 effects
IL-16	CD8 T Cells	Chemoattracts CD4 cells
IL-17	Activated Memory T Cells	Promote T cells proliferation
IL-18	Macrophages	Induces INFγ production

3)HISTAMINE : Figure [15]



Histamine is an organic nitrogenous compounds involved in local immune responses as well as regulating physiological function in the gut and acting as neurotransmitter.
Histamine release occurs when allergens bind to mast cell bound IgE antibodies.
Histamine is involved in the inflammatory response, **as a part of an immune response to foreign pathogens , histamine is produced by basophils and by mast cells found in nearby connective tissues.**
Histamine increases the permeability of the capillaries to white blood cells and some proteins, to allow them to engage pathogens in the infected tissues.
Once formed , histamine i.e. either stored or rapidly inactivated by its primary degradative enzymes . **Most histamine in the body is generated in granules in mast cells and in WBC i.e. basophils and eosinophils.** Mast cells are especially numerous at site of potential injury, internal body surfaces & blood vessels. Non mast cell histamine is found in several tissues, especially in brain where it functions like neurotransmitter.
Another important site of histamine storage and release is the enterochromaffin like (ECL) cells in stomach.
Histamine release in the respiratory system increases vascular permeability causes fluid to escape from tissues, which leads to classic symptoms of runny nose & watery eyes.
Allergens can bind to IgE-loaded mast cells in the mucus membrane of nasal cavity which can lead to clinical response like sneezing, hypersecretion & nasal congestion due to vasodilation & increased permeability.

4) PLATELET ACTIVATING FACTOR / PAF :

Platelet Activating Factor - is a potent phospholipid activator and mediator of many leukocyte functions including platelet aggregation and degranulation , inflammation. It is also involved in changes to vascular permeability , augmentation of arachidonic acid metabolism in phagocytes .
Biosynthesis :
PAF is produced by stimulated basophils , monocytes , neutrophils , platelets and endothelial cells . A variety of stimuli can initiate the synthesis of PAF.
It is continuously produced by these cells in very low quantities and in larger quantities by inflammatory cells in responses to specific stimuli.
Functions :
The PAF signalling system can trigger inflammatory and thrombotic cascades, amplify these cascades when acting with their mediator and mediate molecular and cellular

interactions between inflammation & thrombosis . **PAF initiates an inflammatory response in allergic reactions. It is an important response in allergic reactions.**
It is an important mediator of bronchoconstriction. It causes platelets to aggregate and blood vessels to dilate.

5. GM-CSF- Granulocyte Macrophage Colony Stimulating Factor :
GM CSF- Granulocyte Macrophage Colony Stimulating Factor which is also known as Colony Stimulating Factor 2 (CSF 2) , is a monomeric glycoprotein secreted by macrophages , T cells , Mast cells , NK cells , endothelial cells and fibroblasts that functions as cytokine upon receiving stimuli .
It acts as cytokine and which is white blood cell growth factor .
GMCSF facilitates development of the immune system and promote defence against infection .
GMCSF stimulates stem cells to produce granulocytes (neutrophils , eosinophils and basophils) and monocytes . Thus , it is a part of the immune / inflammatory cascade , by which activation of a small number of macrophages can rapidly lead to an increase in their numbers , a process crucial for fighting infection .

ROLE OF GUT IN IMMUNO- INFLAMMATORY CASCADE :

Primary function of GI tract is that of chemical and physical digestion of food and the absorption of nutrients , however, due to its continuous antigen exposure , the GIT also has an important defensive immunological system .

Recent advances in research in this context suggest that **the GIT's immunological participation is facilitated by the mucosa associated lymphoid tissues , thought to share the mucosal immunological system with the respiratory mucosa associated lymphoid tissues . As a result of this shared mucosal immunity , it has been hypothesised that bronchial asthma may be able to affect the body's GIT in the same pathophysiological manner as the airways and lungs .**

The examination of GIT amongst asthmatics has shown various pathological alterations , some of which correlates to that seen in respiratory system , under similar conditions ,

and may have arisen due to bronchial asthma using the common mucosal immunological system .

The common mucosal system :

The gut associated lymphoid tissue (GALT) is the specialised barrier with which the mucosal immune system is associated within the GI tract .

Mucosa associated lymphoid tissues are resident not only in GI tract but also within respiratory tissues . Both the respiratory tissues and GIT associated mucosal surfaces have numerous common morphological and functional characteristics , with the mucosal immunological system believed to be one such common features .

The mucosal Immune system comprises of three lines of defence :

1.The non-specific first line of defence system - the epithelium cells which essentially act as a sieve with the aim of preventing foreign , unwanted antigens from penetrating mucosa .

2.The Innate defence system – composed of natural killer cells, macrophages and epithelial cells .

3.The Adaptive Immune defence system – composed of lamina propia , lymphocytes and Peyer's patches .

M cells or Microfold cells are found in the Follicle associated Epithelium of the Payer's patches as well as in the Bronchus Associated Lymphoid Tissues (BALT) . They transport the antigens to immune cells across the epithelial barriers stimulating mucosal immunity .

Animal experiments have proven selective trafficking of lymphocytes occur between these two surfaces , with migration being facilitated through the lymphatic and circulatory systems that connect the body's various glandular and mucosal sites . Though very little data exists to support this occurrence in humans . Human B & T lymphocytes , macrophages and mast cells do appear to communicate between lymphoid population of mucosal tissues .

Overlapping pathological features described in literature between body's lungs and airways , stomach and small intestines , underlines strong connection between two having same pathophysiological pathway .

The stomach and small intestines has been observed undergoing various structural histological alterations in asthmatics like cellular atrophy , haemodynamic alterations ,

leukocytes influx , alteration in mucus production , blood vessels alterations , cytokine alterations , GIT permeability , goblet cells alterations etc. [1] , [2]

Scientist have also found that endogenous serotonin (which is maximum secreted by entero-chromaffin cells found in GIT) had been involved in pathophysiological reactions resulting in hypersensitivity , vasculitis of small pulmonary arteries and arterioles . This endogenous serotonin triggers the abovementioned cellular changes leading to infiltration of immunologically active cells like lymphocytes , acrophages & mast cells into respiratory mucosa . This further stimulates the production of pro-inflammatory cytokines like IgE , prostaglandins and interleukins to furthermore flare up the inflammation. [3]

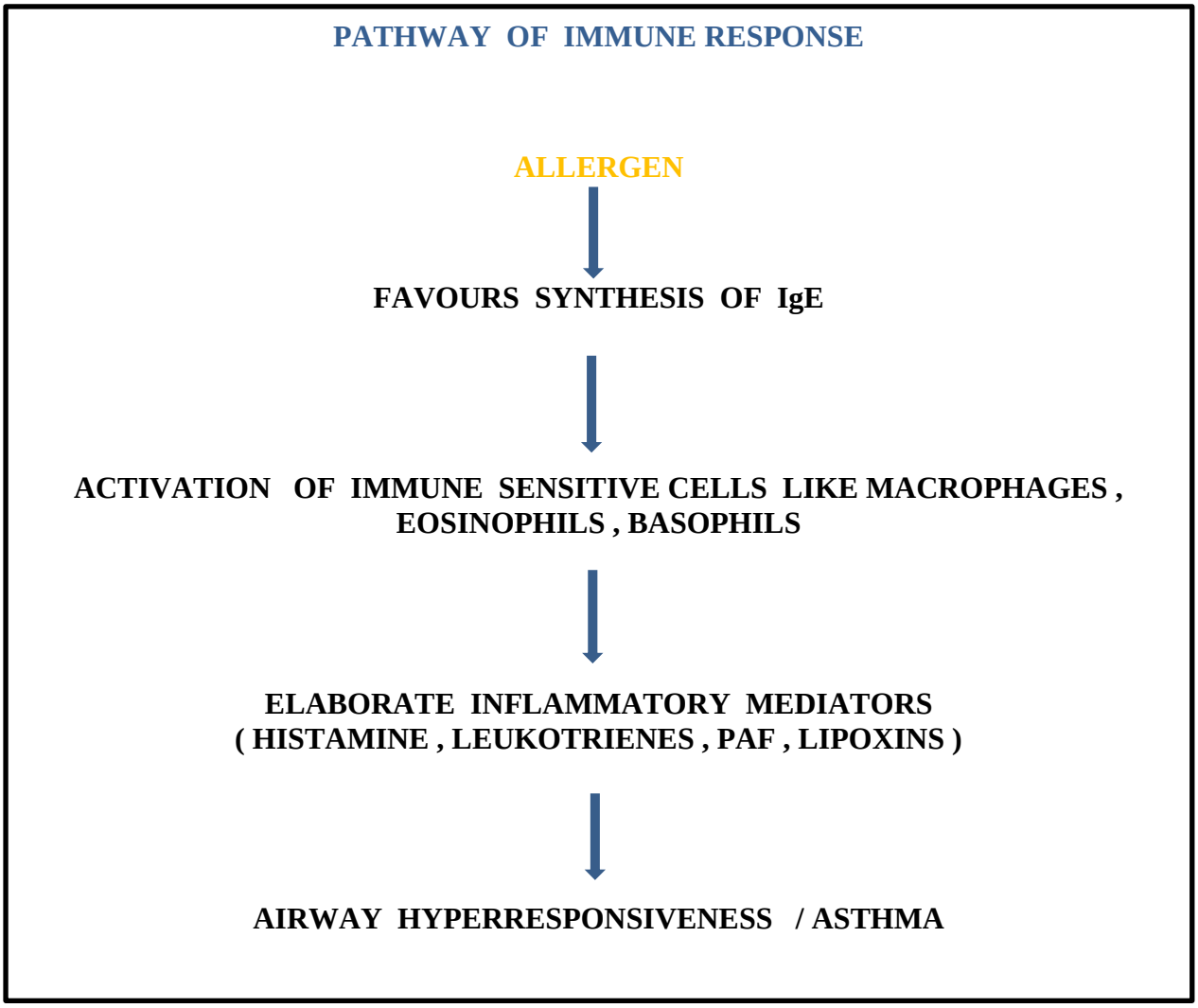
REFERENCE :

1) " Gut and Bronchus associated lymphoid tissue " - John Bienenstock & Dean Befus . American Journal of Anatomy - July 1984 , volume -170, Issue 3,Page 437-445

2) " The impact of asthma on the gastrointestinal tract (GIT) " - Warren Antonio Vieira , Etheresia Pretorius . Journal of Asthma and Allergy - September 2010 ; 3: 123-130 .

3) " Clinical studies on the role of Serotonin in Bronchial Asthma "
- by Mary Katharine Hajos , Acta Allergologica ,1962 , XVII , 358-370.

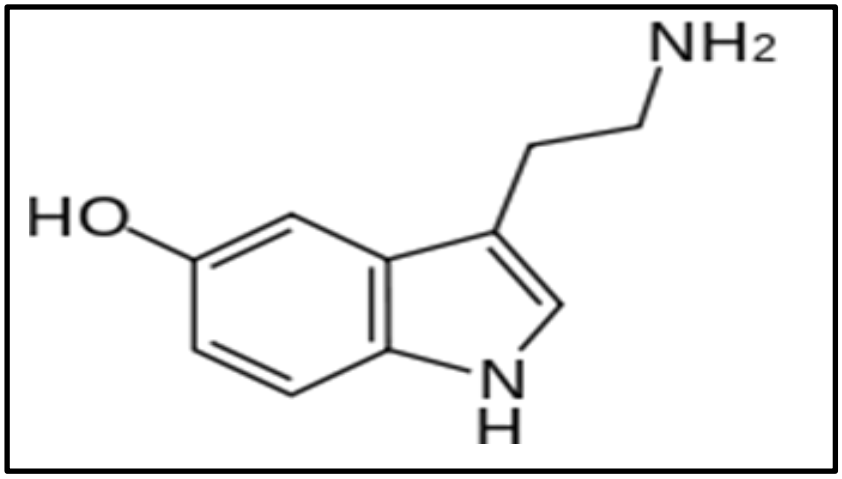
Flow chart [7] Pathway Of Immune Response



Serotonin

SEROTONIN

Pictoral depiction of Serotonin molecule Figure [16]



Chemical Formula : C10H12N2O

In 1935, Italian Vittorio Espier showed an extract from enterochomaffin cells made intestines contract. Espier was able to show it was a previously unknown amine, which he named 'Enteramine'.

In 1948 Maurice M. Rapport, Arda Green and Irvine Page of the Cleveland clinic found a vasoconstrictor substance in blood serum a single complex composed of creatinine and indol-derivates, and since it was serum agent affecting vascular tone, they named it 'Serotonin'.

In 1952, enteramine was shown to be the same substance as serotonin and the broad range of physiological role was elucidated, the abbreviation 5-HT of the proper chemical name 5-hydroxytryptamine became the preferred name in the pharmacological field.

In 1953, Betty Twarog and Page discovered serotonin in central nervous system.

Synonyms of serotonin include :

5-hydroxytryptamine , thrombotin , enteramine , substance DS and 3-(beta amino ethyl) - 5-hydroxyindole.

Serotonin or 5-hydroxytryptamine(5-HT) is a monoamine neurotransmitter.

Biochemically derived from tryptophan, Serotonin is primarily found in the Gastrointestinal Tract (GI tract) , blood platelets and the central nervous system (CNS) in animals including humans.

Tryptophan :

Tryptophan is one of the 22 standard amino acids and an essential amino acid in the human diet .

For humans tryptophan is an essential amino acid means that cannot be synthesized by the organism , so must be part of the diet . Amino acids are building blocks in protein biosynthesis.

Tryptophan functions as a biochemical precursor for the compounds like Serotonin , Melatonin , Niacin (A vitamin) and Auxin.

Serotonin is popularly thought to be a contributor to feelings of wellbeing and happiness. Approximately 90% of the human body's total serotonin is located in the Entero-chromaffin cells in the GI tract, where it is used to regulate intestinal movements.
The remainder is synthesized in serotonergic neurons of the CNS, where it has various functions. These include the regulation of mood, appetite and sleep. Serotonin also has some cognitive functions, including memory and learning. Serotonin has been associated with a myriad of processes , including aggression , sleep , appetite , pain , bone density , tissue regeneration , platelet aggregation , and gastrointestinal function .The influence of 5-HT on the immune system has also been recognized .
Modulation of Serotonin at synapses is thought to be a major action of several classes of pharmacological antidepressants . Declined serotonin level is associated with greater aggressive behaviour , higher level of irritability, impulsivity, aggression , disordered eating and sleeping problems .

Serotonin secreted from the Entero-chromaffin cells eventually finds its way out of tissue into the blood . There, it is actively taken up by the blood platelets , which store it. When the platelets bind to a clot, they release serotonin, where it serves as a vasoconstrictor and helps to regulate haemostasis and blood clotting .
Serotonin also is a growth factor for some types of cells, which may give it a role in wound healing.

There are various serotonin receptors. Serotonin has 2 major different binding profiles.
1. 5HT1 receptor family signals
2.5HT2 receptor family signals

Serotonin is metabolized mainly to 5HIAA, chiefly by liver .

Metabolism involves first oxidation by monoamine oxidase to the corresponding aldehyde. This is followed by oxidation by aldehyde dehydrogenase to 5HIAA , the Indole Acetic Acid derivative. The latter is then excreted by the kidneys.

Biosynthesis

In animals including humans, serotonin is synthesized from the amine acid L-tryptophan by a short metabolic pathway consisting of two enzymes , Tryptophan Hydroxylase (TPH) and aromatic amino acid decarboxylase (DDC)

TPH has been shown to exist in two forms:

TPH1, found in several tissues

TPH2,which is a neuron specific isoform.

Serotonin can be synthesized from tryptophan in the lab . Serotonin taken orally does not pass into the serotonergic pathways of the central nervous system, because it does not cross the blood brain barrier.

However tryptophan and it's metabolite 5-hydroxytryptophan (5-HTP) , from which serotonin is synthesized, does cross the blood brain barrier.

Several classes of drugs target the 5-HT system, including some Anti-Depressants, Antipsychotics, Anxiolytics, Antiemetic and Anti-migraine drugs as well as the Psychedelic drugs .

Serotonylation :

Serotonin can also signal through a non-receptor mechanism called serotonylation , in which serotonin modifies proteins.

The effects of serotonin upon vascular smooth muscle tone (this is the biological function from which serotonin got its name) depend upon the serotonylation of proteins involved in the contractile apparatus of the muscle cells.

Literature Review Of Clinical Studies On Role Of Serotonin On Bronchial Asthma :

1) " Clinical studies on the role of Serotonin in Bronchial Asthma " - by Mary Katharine Hajos , Acta Allergologica ,1962 , XVII , 358-370.

Bronchospastic reaction in Bronchial Asthma are conditioned by 2 processes:

1.Pulmonary allergy responsible for the release of broncho constrictive mediators .
2. Increased pulmonary sensitivity of the effectors to these physiological (acetylcholine) and pathological (histamine) substances .

The cholinergic and histaminic hypersensitivity determines the fundamental pathomechanism of AAR (Antigen Antibody Reaction) , it develops with the disease and has a tendency to have prevalence .

Pharmacological active substances released in AAR are histamine (H) , Acetylcholine (Ach) , Heparin , plasma kinines , Slow Reacting Substances (SRS-A) , permeability factors , leucotaxine and **Serotonin** . **Scientists have found that endogenous serotonin had been involved in pathophysiological reactions resulting in hypersensitivity vasculitis of the small pulmonary arteries and arterioles .**

Some studies stated that serotonin was released in vitro from rabbit platelets after the intravenous injection of antigen into sensitized rabbit . The action of serotonin on the respiration is transmitted by chemical receptors .

Some researchers found direct action on the motor receptors and indirect action through release of parasympathomimetic and sympathicomimetic substances .

Serotonin is further more thought to be an endogenous substance or genuine hormone released in vitro during AAR , yet the diverse clinical symptoms are not inhibited by specific serotonin antagonists .

Some experiments suggest :

i) When serotonin aerosol was inhaled by asthmatics the bronchospastic reaction found positive in 60% patients .

Thus buffered 2% solution of serotonin seems to be valuable in differential diagnosis of bronchial asthma .

Serotonin seems to play an active role in eliciting moderate prolonged dyspnea , in elderly asthmatics .

It is concluded that serotonin is liberated during AAR simultaneously with other reactors .

ii) Broncho-constrictive effect of serotonin is specific , since it could be inhibited by serotonin antagonists in 75 % of cases investigated , whilst antihistamines had the same effect only in 1/3 of cases .

iii) Anti-serotonin drugs are ineffective in bronchial asthma when given orally , but may be beneficial in aerosol treatment .

Thus anti serotonin drugs may be added to the symptomatic treatment of bronchial asthma in certain cases of pronounce serotonin sensitivity .

2) Rabbit basophil derived platelet activating factor (PAF) induces aggregation and release of Serotonin from rabbit platelets ."Activation of Human Platelets by Platelet Activating Factor (PAF) derived from sensitised rabbit basophils" - Martha C et.al. , Immunology , 1979-35-953.

3) Free Serotonin was the only neuroendocrine factor closely associated with clinical severity and pulmonary function suggests that this factor plays an important role in pathophysiology of acute asthma . **Increased levels of free Serotonin in plasma of symptomatic asthmatic patients .**

Fuad Lechin - " Annals of Allergy , Asthma and Immunology " , September 1996 , Volume 77, Issue 3, Page 245-253 .

4) Serotonin (5-hydroxytryptamine / 5 HT) causes bronchoconstriction in most animal species , but not constriction of human airways and its relevance in asthma is doubtful . Peter Barnes et.al. ,Pharmacological reviews",Dec 1,1998,Vol.50,no.4,515-596.

5) 5-HT modifiers as a potential treatment of Asthma - Mario Cazzola et.al. , Trends in Pharmacological Sciences ,1 Jan. 2000 , Vol.2 , Issue 1 , Page 213-216 .

Increased levels of free HT have been shown to be present in the plasma of symptomatic asthmatic patients compared with levels in asymptomatic patients . Free 5HT has been shown to correlate positively with clinical status and negatively with pulmonary function .

These findings suggests that 5HT might play a role in the pathophysiology of acute asthma .

6) "Serotonin modulates the cytokine network in the lung , involvement of prostaglandin E2 " - G. Menard , V Turmel et.al.

Clinical and Experimental Immunology –The Journal of Translational Immunology . 2007 November , 150(2) : 340-348 .

Serotonin has been shown to modulate immune responses .**The plasma level of Serotonin is increased by symptomatic asthmatic patients** and the use of anti-depressants , known to reduce Serotonin levels , provoke a decrease in asthma symptoms and an increase in pulmonary function .

Results suggest that Serotonin alters the cytokine network in the lung through the production of PG E2 .

7) " Platelet Serotonin modulates Immune functions " - Mauler M , Bode C, et.al. , Hamostaseologie , 2015 Feb. 19.35(2) .

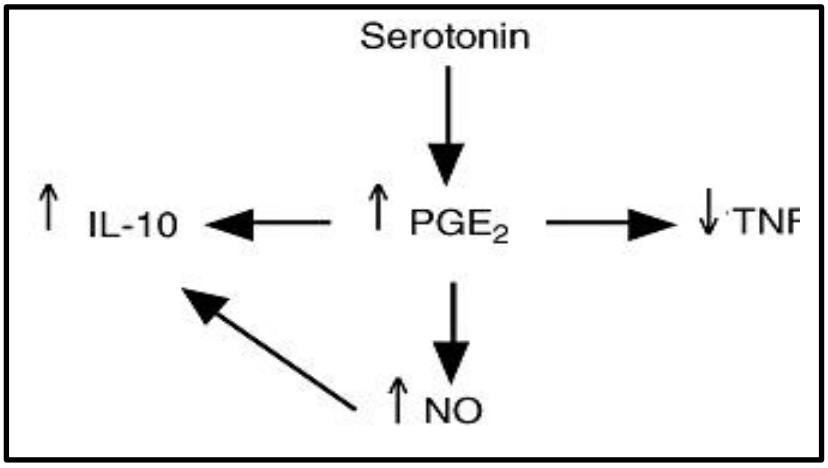
Platelets transport Serotonin at a high concentration in dense granules and release it upon activation . **Serotonin levels were elevated in Immunological diseases like asthma** and it influences a variety of immune functions .

8) " Role of platelets in allergic airway inflammation " - Idzko M , Pitchford S & Page C , in Journal of Allergy Clinical Immunology , 2015 June , 135 (6) : 1416-23 .

Evidence suggests an important role for platelets and their products (β thromboglobulin , thromboxane or serotonin) in pathogenesis of allergic diseases . Variety of changes in function have been observed in patients with asthma , such as alteration in secretion , expression of surface molecule , aggregation and adhesion .

Figure [17]

Schematic depiction of role of Serotonin in cascade of mediators in Bronchial asthma:



In the airway inflammation of asthma , the airway wall is infiltrated by T lymphocytes bearing the T helper type 2 phenotype and by eosinophils and mast cells. **More importantly all these cells get stimulated for the further secretion of inflammatory cytokines through the medium of Serotonin . Serotonin plays a key role in initiating this changes by influencing Ig E secretion . This Serotonin initially secreted by Enterochromaffin cells in gut but further gets concentrated in Platelets .**

Each of these cells thought to contribute to the physiologic changes that characterize asthma. The TH2 lymphocytes produce a limited panel of cytokines including IL3, IL4, IL5 and GM-CSF (Granulocyte Macrophage – Colony stimulating Factor).

The net effect of antigen presentation in micro environment is to promote synthesis of IgE through the actions of IL4 on Ig isotype switching and to enhance the differentiation , migration and patho-biologic capacity of eosinophils through the actions of GM-CSF,IL3 and IL5.

Exposure to allergen favour the synthesis of IgE , the binding of IgE results in immunologically specific sensitization of mast cells, monocytes/macrophages, eosinophil & basophils.

When activated ,these cells elaborate mediators of inflammation, including histamine, leukotrienes ,lipoxins, platelet activating factor and various proteases into the local microenvironment.

Together these mediators and cytokines transduce the physiologic changes that we recognize as asthma namely , airway obstruction and hyper responsiveness.

Airway hyper responsiveness is thought to result from some combination of submucosal oedema , airway epithelial infiltration with eosinophils & lymphocytes damage to bronchial epithelial cells with loss of regulatory mechanisms .

Investigators conclude that IL5 & eosinophils are central mediators in the pathogenesis of allergic lung diseases.

Multiple pathways can lead to the same clinical phenotype ,namely airway hyper responsiveness. Individuals with asthma differ in their development of airway hyper responsiveness.

9) " The impact of asthma on the gastrointestinal tract (GIT) " - Warren Antonio Vieira , Etheresia Pretorius . Journal of Asthma and Allergy - September 2010 ; 3: 123-130 .

Both the respiratory tissues (BALT) and gut associated mucosal surface (GALT) have numerous common morphological and functional characteristics , with the mucosal immunological system believed to be one such common feature .

Scientist have also found that endogenous serotonin (which is maximum secreted by entero-chromaffin cells found in GIT) had been involved in pathophysiological reactions resulting in hypersensitivity , vasculitis of small pulmonary arteries and arterioles . This endogenous serotonin triggers the abovementioned cellular changes leading to infiltration of immunologically active cells like lymphocytes , macrophages & mast cells into respiratory mucosa . This further stimulates the production of pro-inflammatory cytokines like IgE , prostaglandins and interleukins to furthermore flare up the inflammation .

AIM & OBJECTIVES

Aim :

To underline the physiological importance of '*Mahasrotas*' as the *Moolsthana* of '*Pranavah srotas*.'

Objectives :

1) Clinically observe relation between *Pranvaha srotas* and *Mahasrotas* , in *Tamakshwasa* .
2) To estimate plasma Serotonin level in *Avegavastha* and *Vegavastha* of *Tamak Shwasa* .

Hypothesis :

H_0 - Null hypothesis - no change in serum serotonin concentration during exacerbatory and remission phases of asthma .

No clinical association between *Mahasrotas* and *Pranavaha Srotas* with reference to *Tamakashwasa* .

H_1 - Alternative hypothesis - change in serum serotonin concentration during exacerbatory and remission phases of asthma .

There is clinical association between *Mahasrotas* and *Pranavaha Srotas* with reference to *Tamakashwasa* .

MATERIALS

Peak expiratory flow Meter

In this study patients were assessed for their status of bronchospasm by Peak Expiratory Flow Meter as it was easily available at OPD and could assess the level of bronchospasm to decide *Vegavastha* and *Avegavastha* i.e. phase of exacerbation and remission in *Tamakshwasa* .

The peak Expiratory Flow (PEF), also called Peak Expiratory Flow Rate (PEFR) is a person's maximum speed of expiration, as measured with a Peak Flow Meter, a small, hand-held device used to monitor a person's ability to breathe out air. It measures the airflow through the bronchi and thus the degree of obstruction in the airways.

Fig. [1]

Function :

Peak flow readings are higher when patients are well, and lower when the airways are constricted. From changes in recorded values, patients and doctors may determine lung functionality, severity of asthma symptoms, and treatment.

The normal expected value depends on a patient's sex, age and height. It is classically reduced in obstructive lung disorders such as asthma.

It is important to use the same peak flow meter every time.

To interpret the significance of peak expiratory flow measurements, comparison is made to reference (normal, predicted) values based on measurements taken from the general population. Various reference values have been published in the literature and vary by population , ethnic group, age, sex, height and weight of the patient. For this reason tables or charts are used to determine the normal value for a particular individual.

Peak flow readings are classified into 3 zones of measurement according to the American Lung Association ; green, yellow, and red.

Green Zone

80 to 100 percent of the usual or normal peak flow readings are clear. A peak flow reading in the green zone indicates that the asthma is under good control.

Yellow Zone

50 to 79 percent of the usual or normal peak flow readings .

Indicates caution and may mean respiratory airways are narrowing and additional medication may be required.

Red Zone

Less than 50 percent of the usual or normal peak flow readings .

Indicates a medical emergency. Severe airway narrowing may be occurring and immediate action needs to be taken.

In this study severe cases were excluded from the study, sample population was having only moderate bronchospasm were included in the study having Peak Flow Meter Reading between 50 -79 % which is said to be moderate bronchospasm .

Elisa Procedure For Serum Serotonin Estimation

By ELISA Test 'Serum Serotonin' was estimated in patients of *Tamkashwasa* in ***Vegavastha*** and ***Avegavastha*** .

For that serum of the blood samples was separated by centrifuging and stored in deep freezer till the test done .

Normal Range of Serum Serotonin :

Female : 80-450 ng/ml

Male : 40-400 ng/ml

Here is the **overview of the ELISA Test** done on sample serums .

Fig. [2]

Fig. [3]

Fig. [4]

Contents of the Kit :

1) Micro Titre Stripes (M T Stripes)

2) Standards 1-6

3) Control 1 & 2

4) Acylation Buffer

5) Acylation Reagent

6) Antiserum

7) Enzyme Conjugate

8) Wash Buffer

9) Substrate

10) Stop Solution

11) Reaction Plate

12) Equalising Reagent

Preparation of Reagents and Samples :

1) Microtiter Stripes : Before opening the packet let them stand at room temperature for at least 10 minutes before use .

Unused stripes should be kept resealed with desiccant at 2-8^0 C for storage.

Fig. [5]

2)Wash Buffer :

Dilute the content of Wash Buffer with 1000 ml of distilled water . Prepared diluted wash buffer should be stored at 2-8^0 C.

3) Equalising Reagent :

Dissolve the content of ER in 20.5 ml distilled water ,mix shortly and leave on roller mixer for 30 minutes . Handle carefully to minimise foam formation .

Fig. [6] **Preparation of Samples (Acylation) :**

The wells of reaction plate can be used only once so mark the respective wells before using .

1) Pipette each 20 µl standard 1-6 , each 20 µl control 1 & 2 , each 20 µl serum into respective wells of the reaction plate .

2) Pipette each 20 µl Acylation Buffer into all wells .

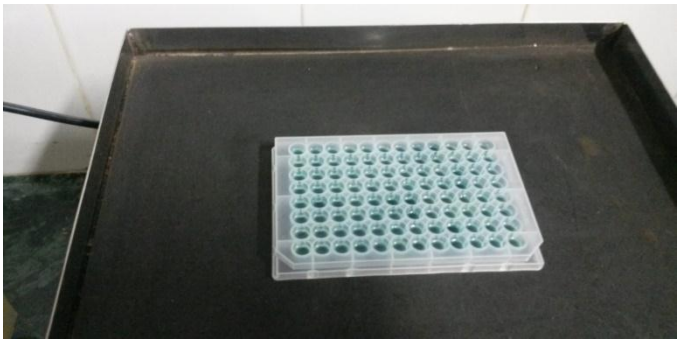
3) Pipette each 20 µl Equalising Reagent into all wells . Shake plate on orbital shaker for 10 seconds .

4) Pipette each 20 µl Acylation Reagent into all wells , mix immediately . As Acylation Reagent reacts with many plastics , use Eppendorf multipipette , fill the syringe directly from the vial and add well by well .

5) Incubate for 15 minutes at room temperature (approximately 20^0 C) on an orbital shaker . Colour changes to green .

6) Take each 20 µl for ELISA .

Fig. [7] **Orbital Shaker**



Test Procedure ELISA

1) Sample Incubation

Pipette each 20 µl prepared standards 1 to 6 , pipette each 20 µl prepared controls and pipette each 20 µl prepared samples into the respective wells of the coated microtiter strips .

Pipette each 100 µl Antiserum into all wells .

Incubate for 30 minutes at room temperature on an orbital shaker .

2) Washing

Discard or aspirate the contents of the wells and wash thoroughly with each 250 µl Wash Buffer .

Repeat the washing procedure 3-4 times . Remove residual liquid by tapping the inverted plate on clean absorbent paper .

3) Conjugate Incubation

Pipette each 100 µl Enzyme Conjugate into all wells .

Incubate for 15 minutes at room temperature on an orbital shaker .

4) Washing

Discard or aspirate the contents of the wells and wash thoroughly with each 250 µl Wash Buffer .

Repeat the washing procedure 3-4 times . Remove residual liquid by tapping the inverted plate on clean absorbent paper .

5) Substrate Incubation

Pipette each 100 µl Substrate into all wells and incubate for 15± 5 minutes at room temperature on an orbital shaker .

6) Stopping

Pipette each 100 µl Stop Solution into all wells .

7) Reading Read the optical density at 450 nm (reference wavelength between 570 and 650 nm) in a microplate photometer .

Fig. [8] Incubation ,Washing , Stopping

Fig. [9] Incubation ,Washing , Stopping

Fig. [9] Elisa Plate Reader

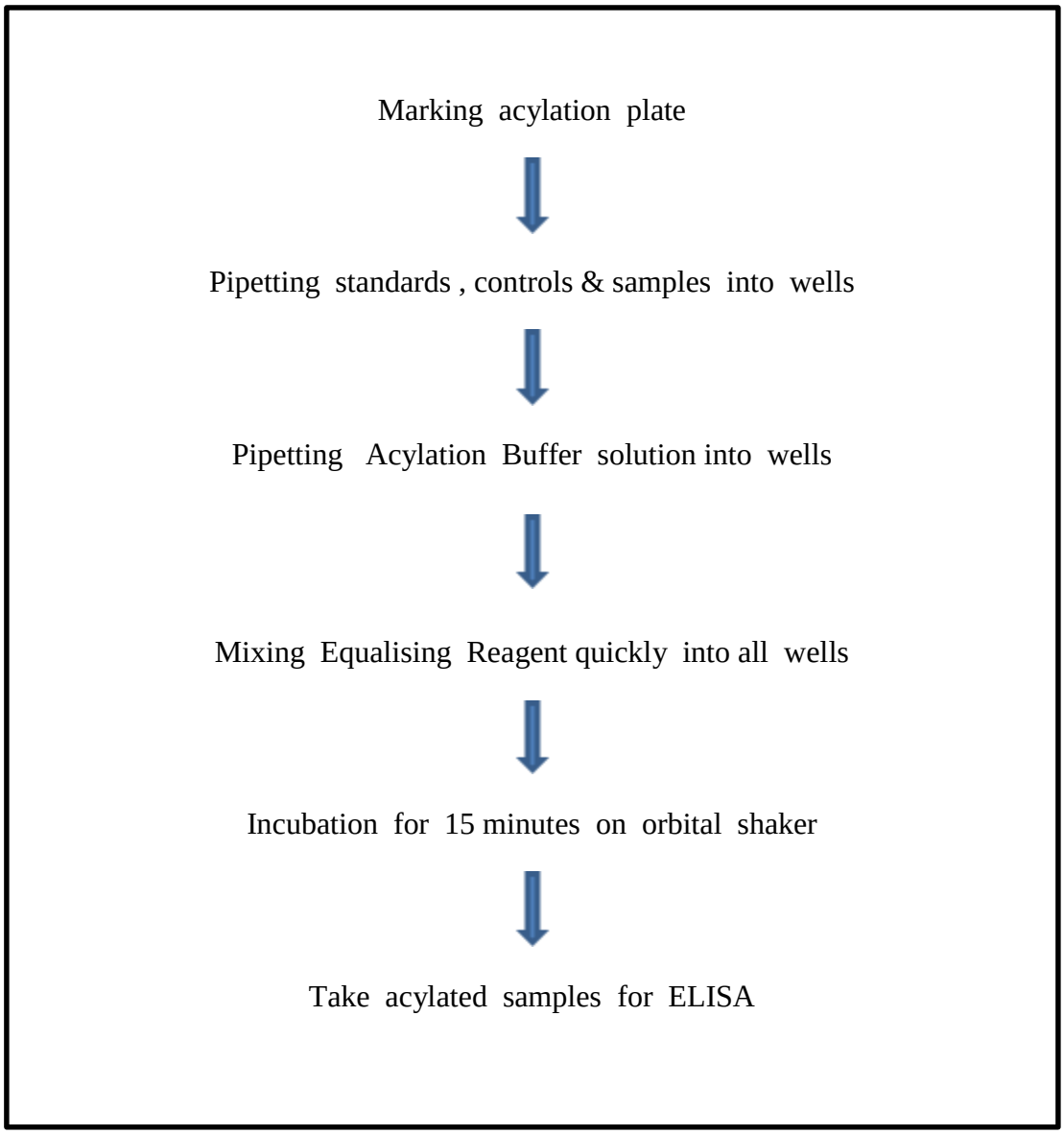
SCHEMATIC DEPICTION OF ELISA TEST PROCEDURE

A) ELISA Preparation

- Bringing Micro Titer plate to room temperature .
- Dilution of wash buffer
- Dilution of Equalising Reagent

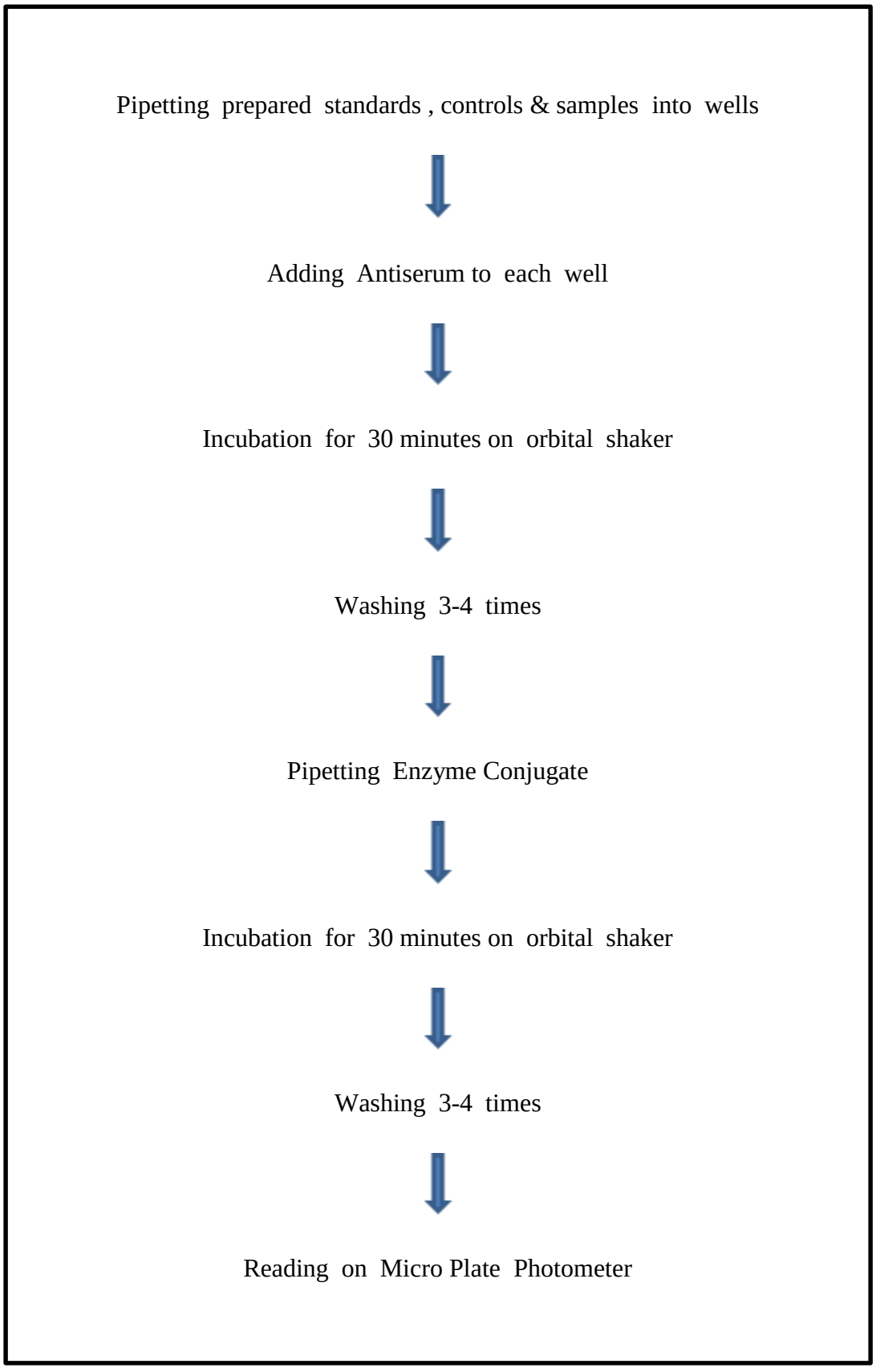
B) ACYLATION

Flowchart [2]



C) Elisa Procedure

Flowchart [3]



METHODOLOGY

Methods :

This was open randomized study .

Sample size : 85 patients of *Tamaka shwasa*

Age : 21 -50 yrs.

Gender : Either

Study centre : Tilak Maharashtra Vidyapeeth

Study site : Dr D Y Patil college of Ayurved , Nerul , Navi Mumbai

Inclusion Criteria :

Sample : 85 diagnosed (clinically , with the help of Peak flow Meter) patients of chronic *TamakShwas* in *Vegavastha* (exacerbation) and *Avegavastha* (remission) .

Diognostic criteria of *Tamakashwasa* were as following :

Symptoms :

Peenasa - Nasal secretion ,

Ghurghurak - Wheezing sound in lungs ,

Shwasa pranaprapidka - Shortness of breath with suffocating sensation ,

Pramoha - Giddiness ,

Kasa - cough ,

Nidranash - insomnia ,

Kanthaudwasante - Bad throat ,

Kruchrabhashita -Difficulty in talking ,

Shayanahshwasapidita - Difficulty in breathing in supine position ,

Asinolabhate saukhyam - Feel relieved after sitting ,

Ushnamabhinandati - Feel better with hot things ,

Lalatswidyata - Sweating over head ,

Vishushka aasya - Dryness of mouth .

Patients with moderate severity only included in the study .

To assess *Vegavastha* and *Avegavastha* Peak flow meter was used as spirometry was not possible in that state .

Patients were included in moderate *Vega* in the range of 50 to 79 % only .

From Mumbai region .

Chronicity : Having *Tamakashwasa* since 5 years and more than that .

Age : ranging between 21-50 years

Gender : Either

Exclusion Criteria :

Known cases of :

Cardiac Asthma

Any acute respiratory condition

Hypertension

Diabetes Mellitus

Ascites

Kidney disorders

Pregnancy

Any other obstetric conditions

Severe Anemic condition

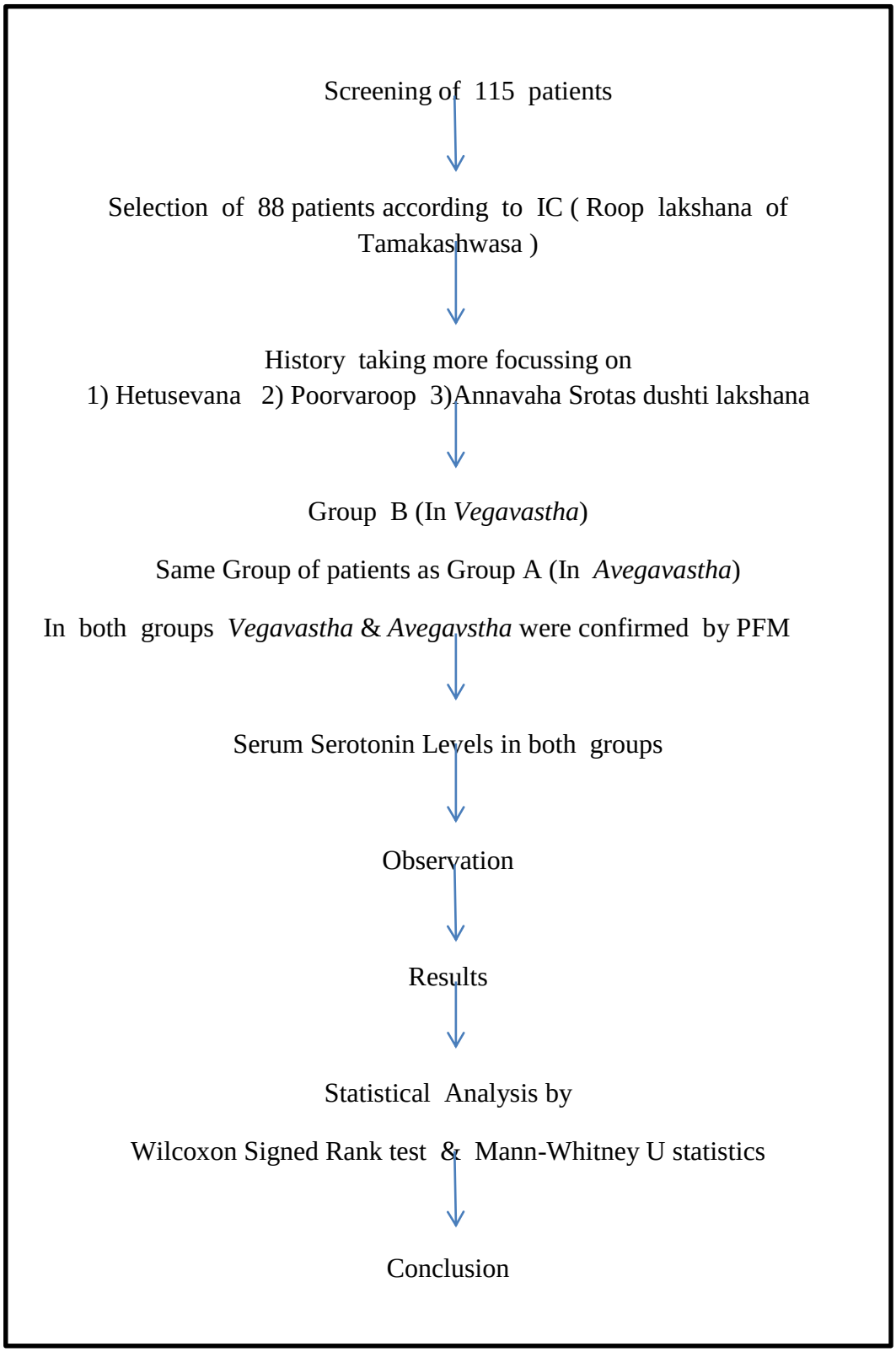
Any major surgery

Patients on steroids

Menopausal conditions

Any other major disease related to GI tract & respiratory tract as well.

Study Design : This was open randomized study .



This study design and methodology has been approved by Ethics Committee of the Tilak Maharashtra Vidyapeeth .

Study Evaluation :

Study evaluation was done based on the findings of the above mentioned parameters using Wilcoxon Signed Rank test & Mann -Whitney U statistics as data was not equally distributed , for quantitative data and charts were prepared for qualitative data recovered from CRF.

Observations were made in set of 88 patients based on the CRF and the Investigations in state *Vegavastha* and *Avegavastha* of *Tamaka shwasa* .

Findings were discussed in the chapter of Discussion .

Conclusions were made on the basis of all observations .

OBSERVATIONS AND RESULTS

INDEX

For the desired study of *Moolsthana* of *Pranavaha Srotas* , diagnosed patients of *Tamakshwasa* (Asthma) were recruited in the study taking their prior written consent .

Following study protocol was followed :

Total 88 diagnosed patients of *Tamakashwasa* were included in the study .
Two groups were assumed of the same set of patients .

Group A : In same set of recruited asthmatic patients Serum Serotonin levels estimated in phase of remission of bronchospasm i.e. *Avegavastha*

Group B : Among included 88 patients , Serum Serotonin levels estimated in phase of bronchospasm i.e. *Vegavastha* .

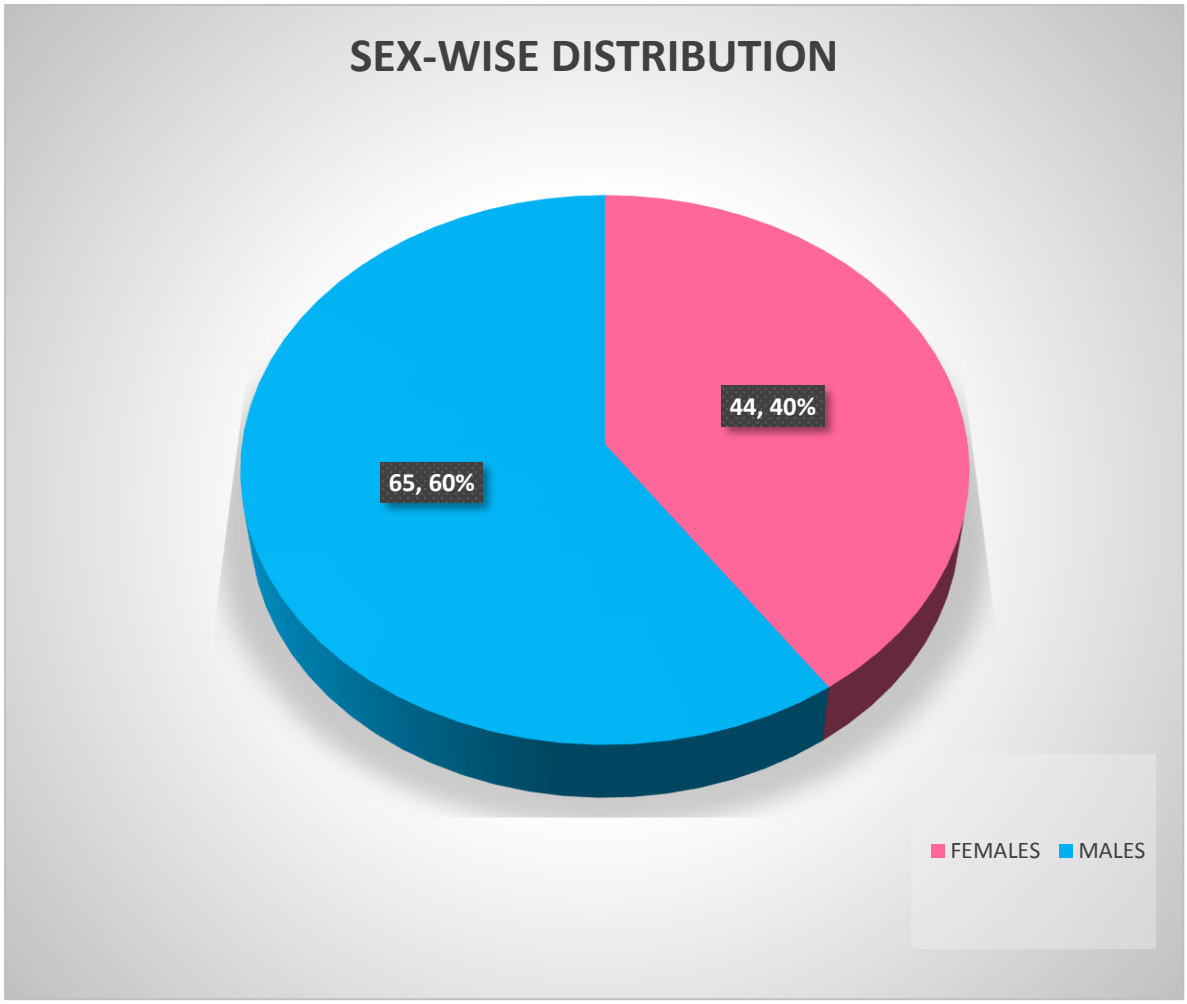
Along with this major Quantitative parameter (of Serum Serotonin level), other parameters like *Prakriti* , *Agni* , *Koshtha* , observations of season of exacerbation , bowel habits and its relation with exacerbation of bronchospasm , *Poorvaroop -Roop lakshana* of *Tamakashwasa* , other GI symptoms related to exacerbation of *Tamakashwas* , different *Hetusevan* and its relation with exacerbation and symtoms of *Pranavaha* & *Annavaha Srotodushti Lakshanas* , according to CRF were taken into consideration for analysis .

Only important and possible significant points which could possibly throw any light over the relation between *Mahasrotas* and the course of pathophysiology of the disease , were subjected to analysis .

QUALITATIVE DATA ANALYSIS :

1) **SEXWISE DISTRIBUTION** OF THE SAMPLE POPULATION :

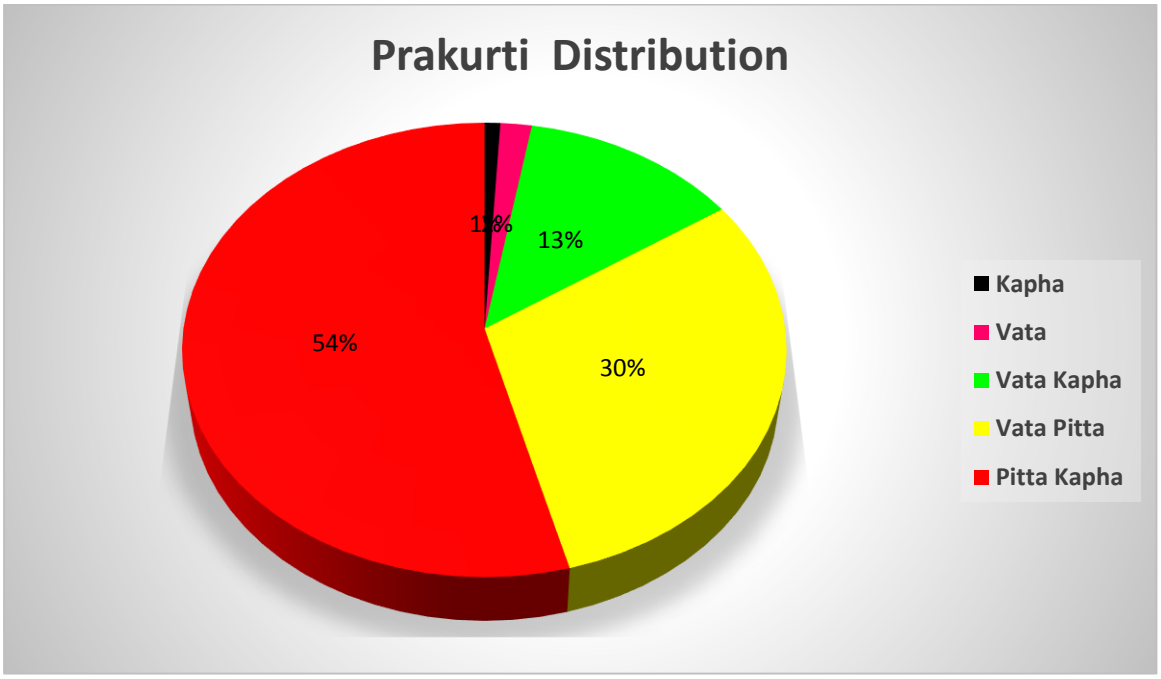
Chart [1]



In total sample size 60% individuals were male and 40% were female .

2) ***PRAKRUTI*** DISTRIBUTION :

Chart [2]



In the sample , individuals were having following distribution of *Prakruti* :

Vata – Pitta Prakruti 30%

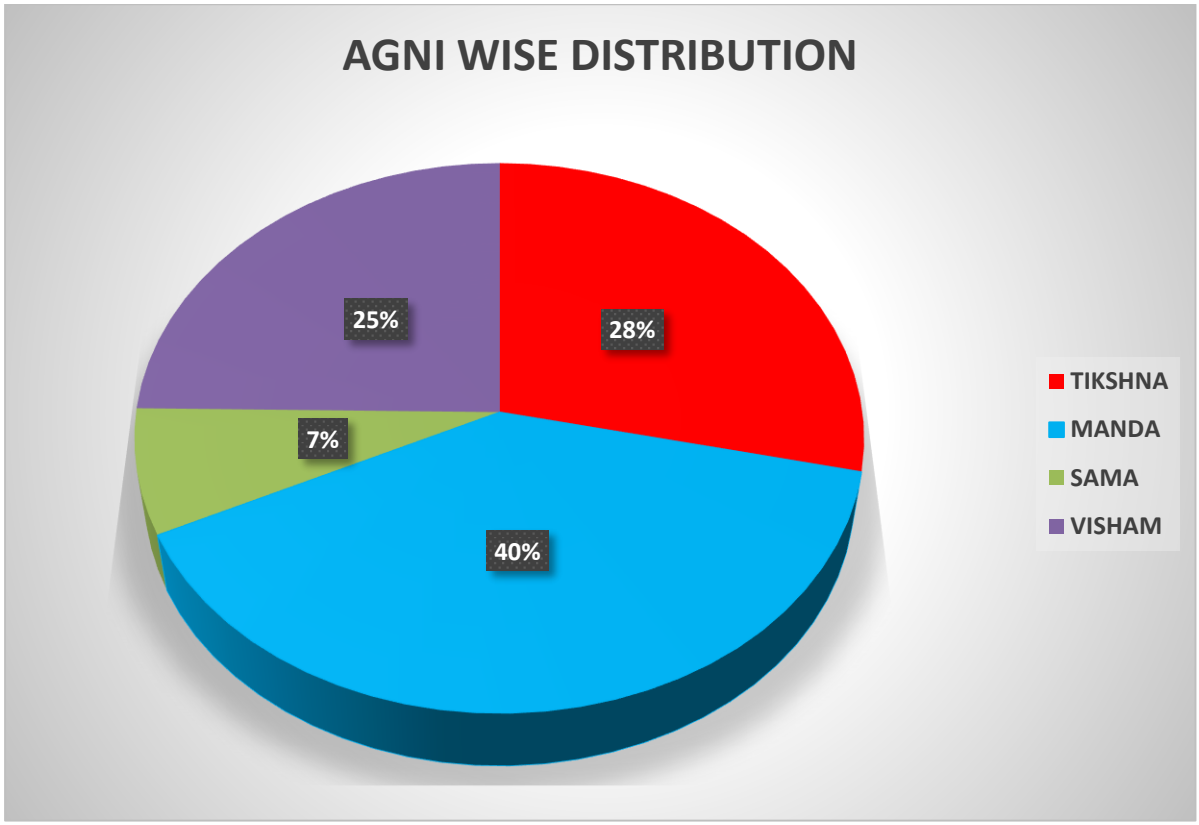
Vata – Kapha Prakruti 13%

Pitta –Kapha Prakruti 54%

Vata 2%

Kapha 1%

3) DISTRIBUTION OF INDIVIDUALS ACCORDING TO ***AGNI*** :
Chart [3]



In the sample , following was the distribution of *Agni* :

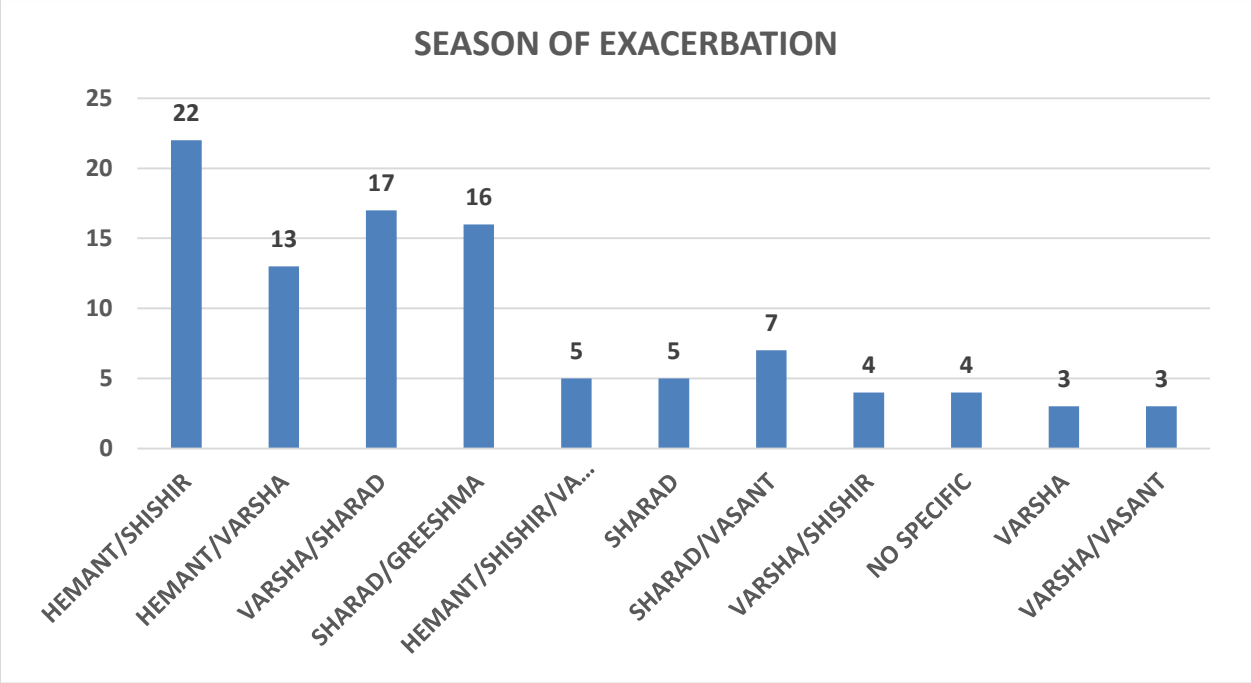
Mandagni 40%

Tikshnagni 28 %

Vishamagni 25%

Samagni 7%

4) DISTRIBUTION OF SAMPLE ACCORDING TO **SEASON OF EXACERBATION : Chart [4]**



In the sample , following is the number of patients having exacerbation of bronchospasm in different seasons :

Hemant Shishir Rutu 22

Varsha Sharad Rutu 17

Sharad Greeshma Rutu 16

Hemant Varsha Rutu 13

Sharad Vasant Rutu 7

Hemant Shishir /Vasant/ Sharad 5

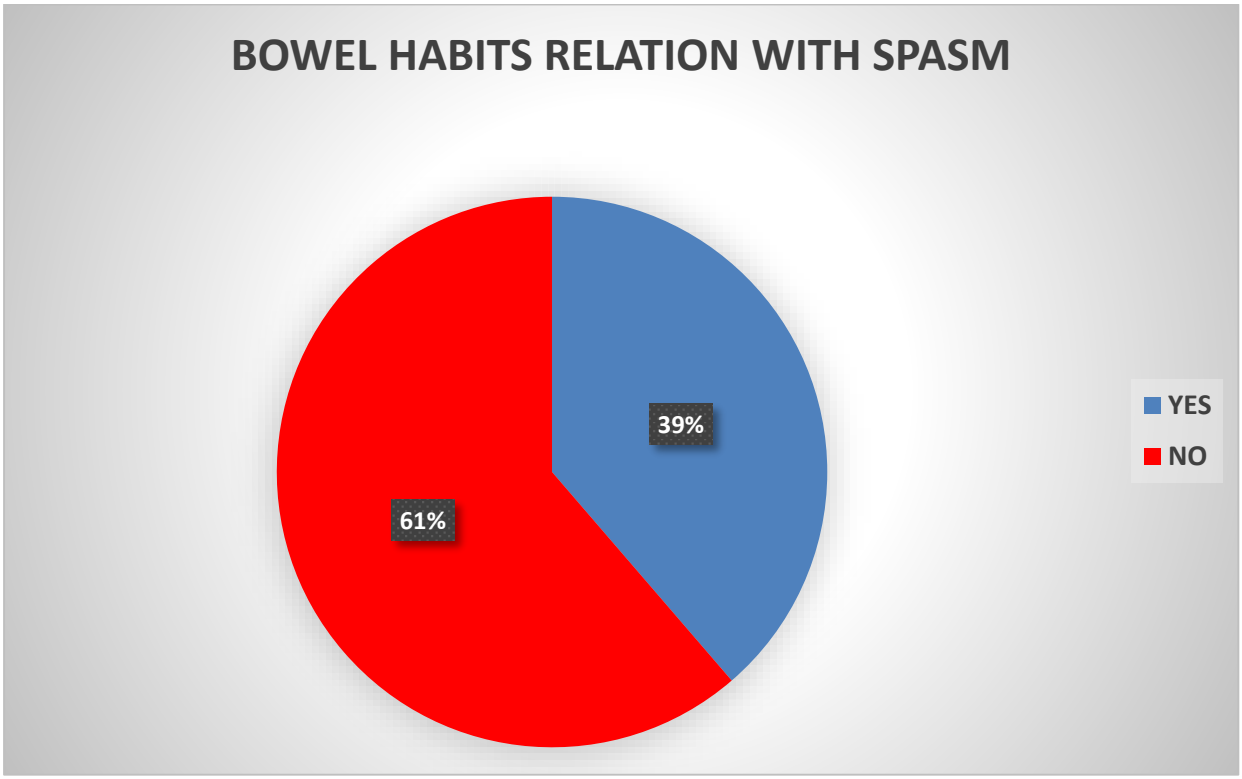
Varsha Shishir Rutu 4

Not specific 4

Varsha /Vasant 3

5) DISTRIBUTION OF SAMPLE SHOWING **RELATION BETWEEN BOWEL HABITS AND BRONCHOSPASM :**

Chart [5]

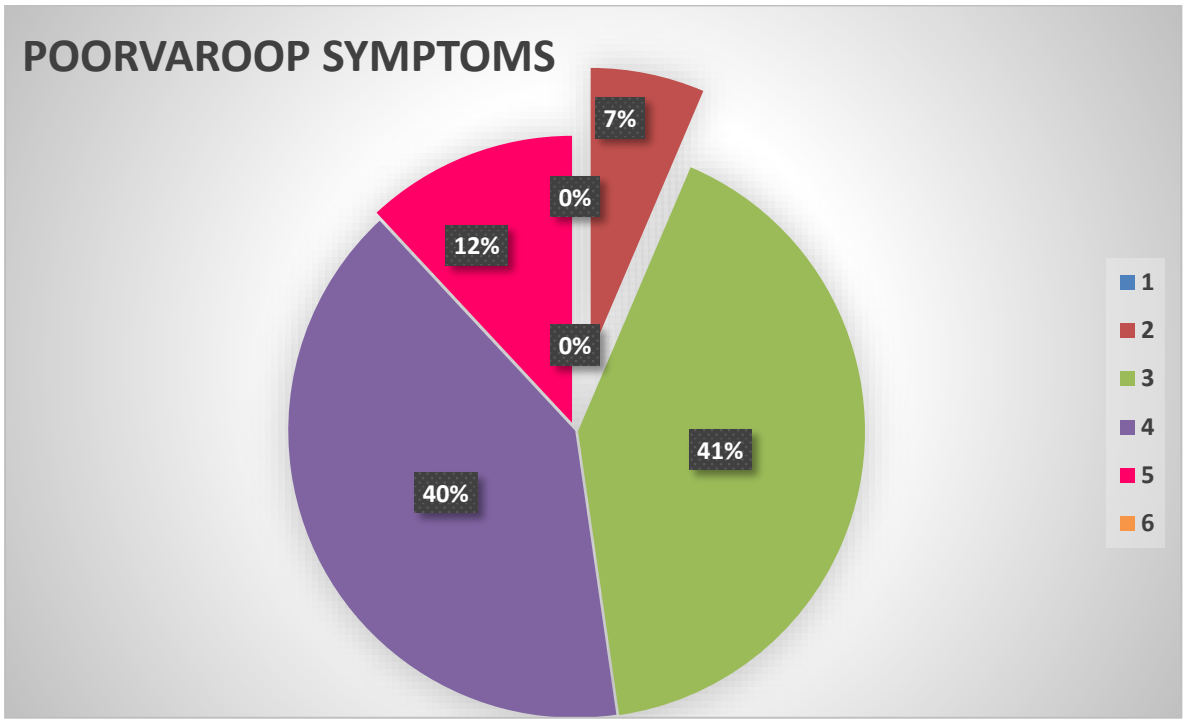


Among sample 35% individuals had positive relation between bowel habits (disturbed GI -constipation / flatulence / bloating etc.) and exacerbation of bronchospasm , 65% individuals showed no relation with altered bowel habit with exacerbation of bronchospasm .

Serum Serotonin concentration was analysed in subjects having positive relation between bowel habits (disturbed GI -constipation / flatulence / bloating etc.) and exacerbation of bronchospasm . **Mann Whitney U statistics was used for analysis and P value is < 0.0001 , with 1235.5 (Mann Whitney Statistics) & 3525.5 (U) which is significant .**

6) DISTRIBUTION OF SAMPLE SHOWING NO OF ***POORVAROOP LAKSHANA*** AMONG TOTAL 6 :

Chart [6]



Among total 6 number of *Poorvaroop Lakshana* :

2 symptoms present : 7%

3 symptoms present : 41%

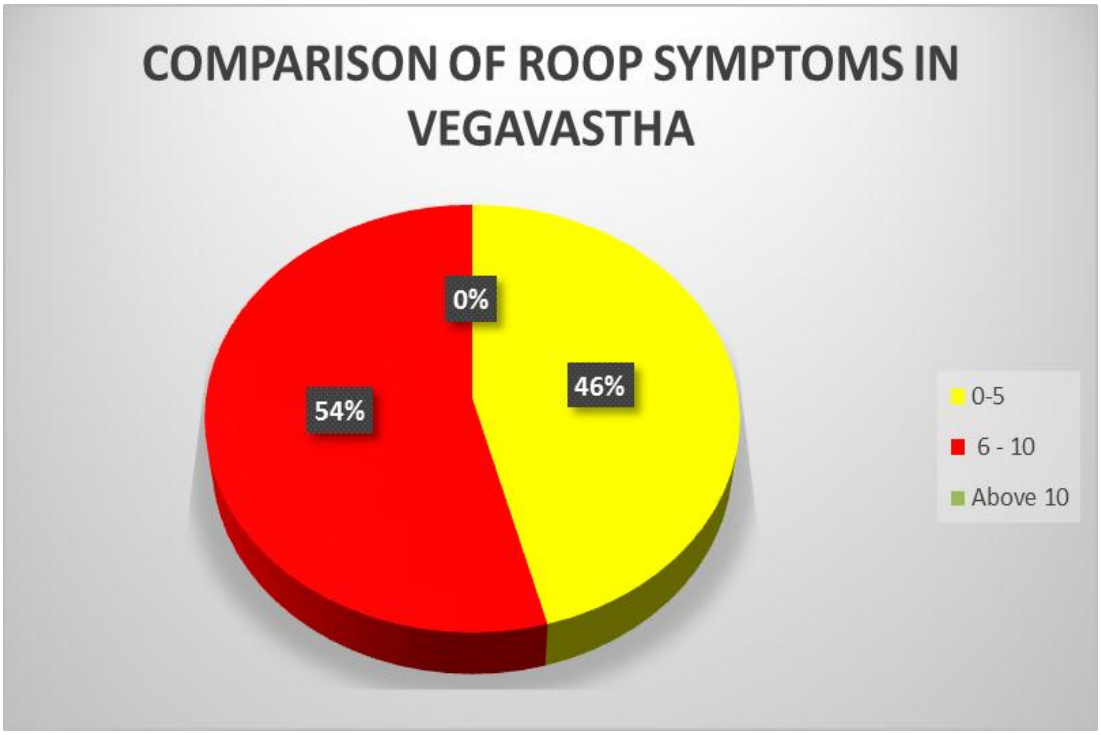
4 symptoms present : 40%

5 symptoms present : 12%

Minimum 1 or maximum 6 : no individual

7) DISTRIBUTION OF SAMPLE SHOWING NO OF ***ROOP LAKSHANA*** AMONG TOTAL 13 :

Chart [7]



Among total 13 number of *Roop Lakshana* :

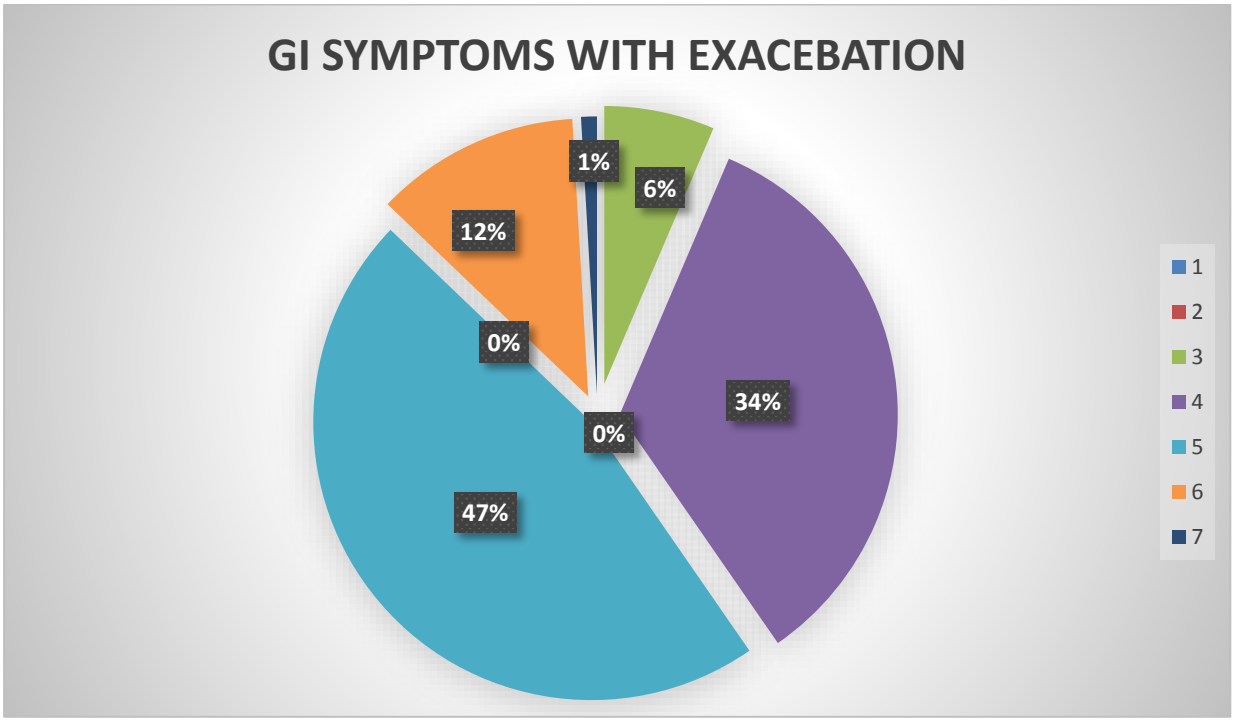
0-5 symptoms present – 46 %

6-10 symptoms present – 54 %

Above 10 : no individual

8) DISTRIBUTION OF SAMPLE ACCORDING TO **PRESENCE OF GASTRO-INTESTINAL SYMPTOMS BEFORE / DURING EXACERBATION OF BRONCHOSPASM :**

Chart [8]



Among total 7 number of Gastrointestinal Symptoms :

1 symptom present : 0%

2 symptoms present : 0%

3 symptoms present : 6%

4 symptoms present : 34%

5 symptoms present : 47%

6 symptoms present : 12%

7 symptoms present : 1%

Serum Serotonin concentration was analysed in subjects having disturbed GI and having symptoms like bloating , acidity indigestion during or before having attack of Bronchospasm . **Mann Whitney U statistics was used for analysis and P value is < 0.0001 , with 1064 (Mann Whitney Statistics) & 3628 (U) which is significant .**

9) DISTRIBUTION OF SAMPLE ACCORDING TO ***DOSHAPRAKOPAK HETUSEVAN*** : **Chart [9]**

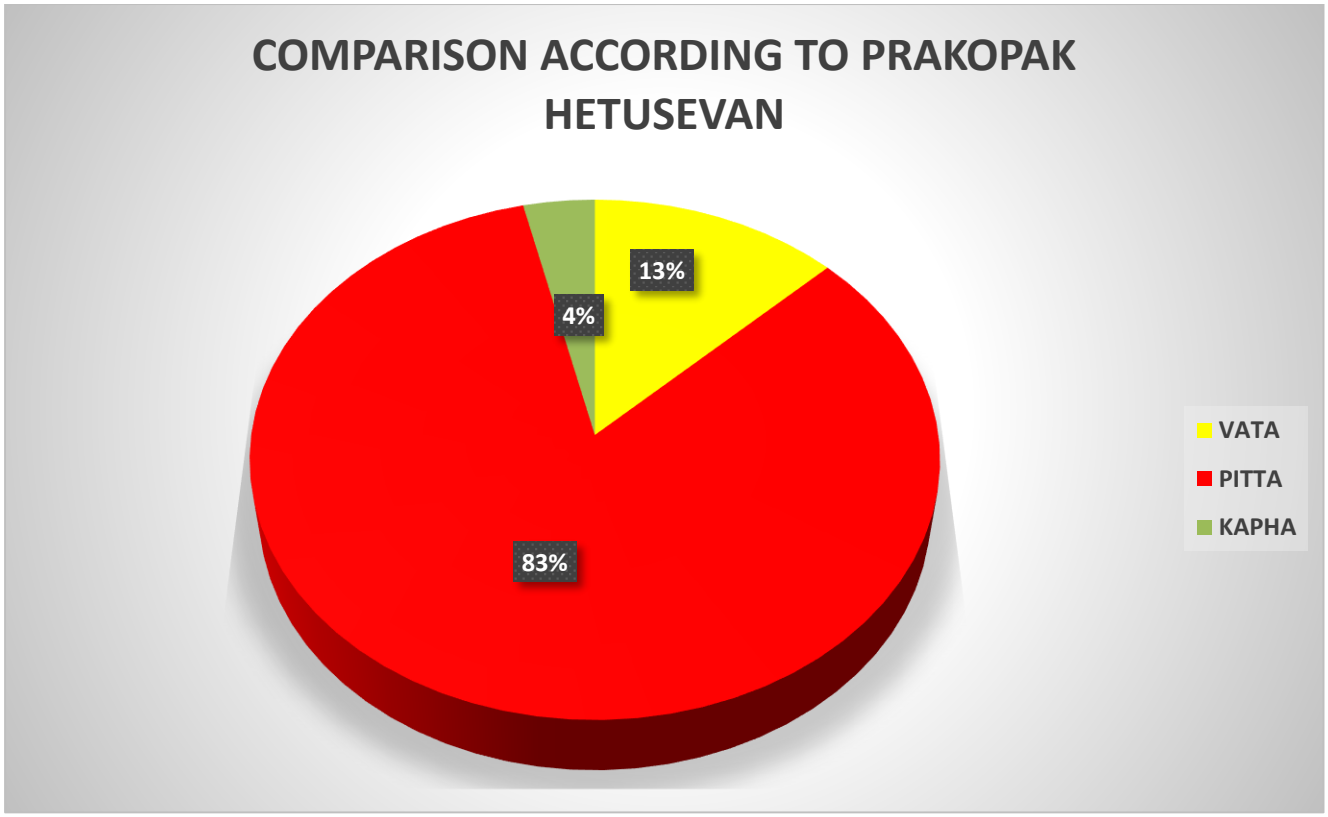
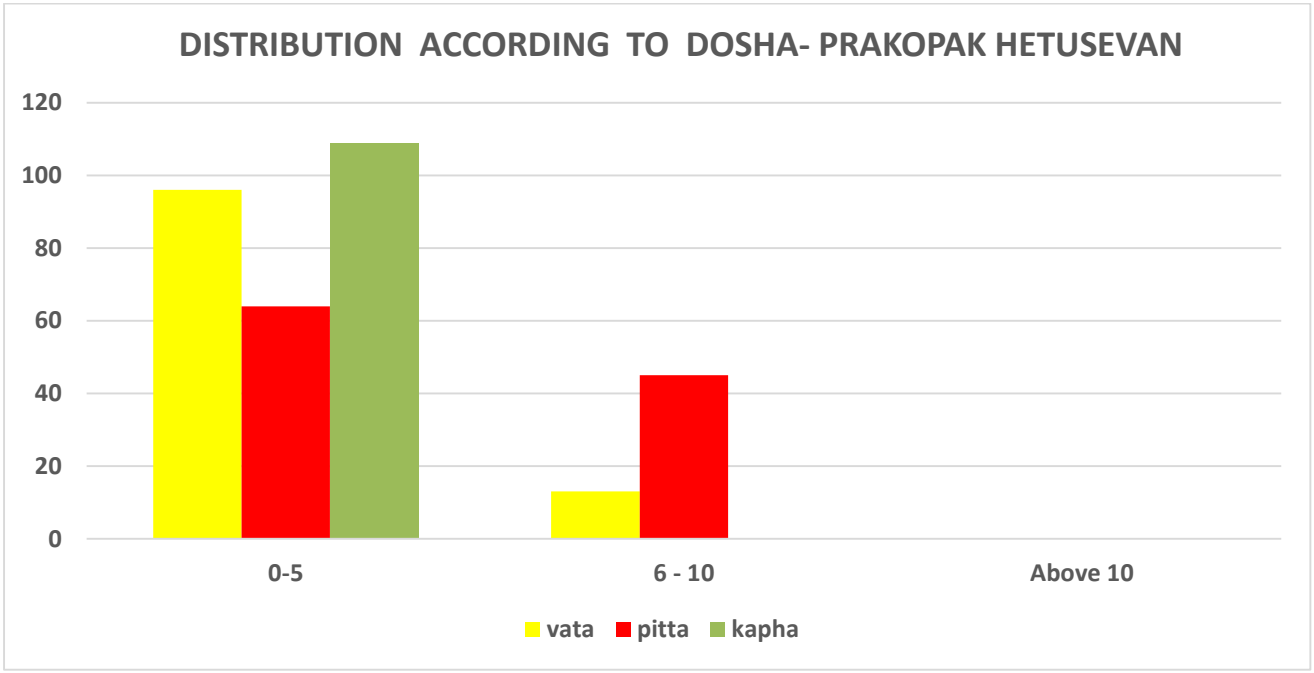


Chart [10]



Patients tend to have number of *Doshaprakopak Hetusevan* . This analysis shows *Doshaprakopak hetusevan* maximum done and also it's magnitude in terms of number of *Hetusevan* .

At each interval / range of number of *Doshaprakopak Hetusevan* all three categories are compared to each other .

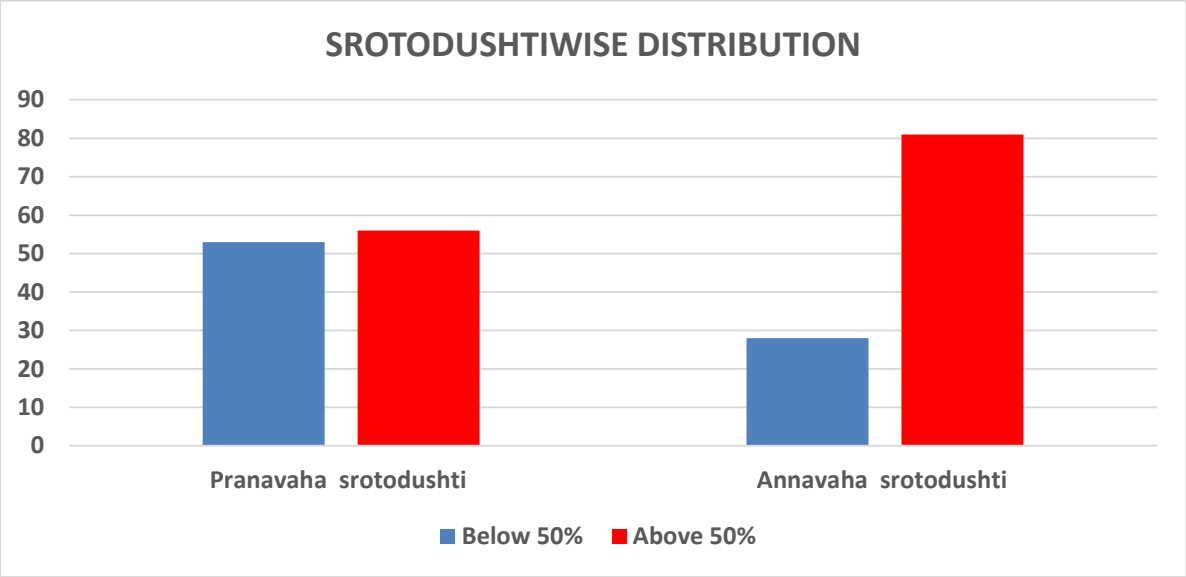
This bar chart shows that patients maximally do *Kapha* and *Vata Prakopak Hetusevan* upto 0-5 number . *Pitta Prakopak Hetusevan* is less than these two but more than moderate level .

6-10 number of *Hetus* are consumed by patients which aggravate *Vata* and *Pitta* . Among that *Pitta Prakopak Hetus* are consumed by maximum number of individuals .

No individual consumes *Prakopak Hetusevan* which is more than 10 in number .

10) DISTRIBUTION OF SAMPLE SHOWING **PRANAVAHA AND ANNAVAHA SROTODUSHTI :**

Chart [11]



Total number of present *Pranavaha Srotodushti Lakshana* and *Annavaha Srotodushti Lakshana* (prior or along with bronchospasm) are compared with total number of symptoms described .

In *Pranavaha Srotodushti Lakshana* around 55% individuals show more than 50% symptoms , of total described .

Whereas in *Annavaha Srotodushti Lakshana* almost 80% people show more than 50% symptoms , of total described .

So it shows that in *Pranavaha srotodushti* , more percentage of patients have *Annavaha Srotodushti* along with .

QUANTITATIVE DATA ANALYSIS :

Serum Serotonin Levels estimated by ELISA :

Serum Serotonin levels in *Avegavastha* and *Vegavastha* in 88 patients of *Tamakshwasa* were estimated by ELISA method .

Following is the statistical analysis of values obtained :

P value =0.0001 , it is extremely significant.

Mean Difference = 137.11

C.I. is 95% (93.982, 180.23) but since the data fails the normality test with p = 0.0001 , we applied the **Wilcoxon Signed Rank test** for which the P value was found to be 0.0006 which is extremely significant.

Hence we can conclude that there is a significant increase in serum Serotonin level during the spasm (*Vegavastha*).

Since P value is less than 0.0001, it is extremely significant .
Mean difference = 137.11
95% C.I. is (93.982, 180.23) .

To support our hypothesis we have analysed Serotonin Concentrations of individuals in whom GI symptoms were observed in exacerbation and Bowel habits positive in spasm. In both analysis Mann-Whitney U statistic Test was applied. U' values were 3525.5 and 3628 respectively which are significant , P value being < 0.0001 .

Hence we conclude that there is a significant increase in serum Serotonin level during the spasm.

DISCUSSION

The prime subject of the Thesis is concerned mainly with *Pranavaha Srotas* and *Mahasrotas* as it's *Moolsthana* .

Serotonin being a major Immuno-modulator neurotransmitter playing major role in Respiratory System which is secreted in gut by entero-chromaffin cells is taken as major quantitative parameter in this study .

In course of referencing and the actual study according to desired protocol , following points were found to be important to understand Concept of *Moolsthana* of *Srotas* as a whole and regarding *Pranavaha Srotas* in particular .

1. Understanding of Concept of *Srotas* from physiological point of view as well as it's sphere of applicability .

2. Developing probable interpretations regarding *Moolsthanas* of *Pranavaha Srotas* considered by different *Acharyas* .

3. In particular validating physiological and clinical relevance of *Mahasrotas* as *Moolsthana* of *Pranavaha Srotas* stated by *Acharya Charak* .

4. Studying the *Ayurvediya* parameters of assessment in *Tamakashwasa* eg. *Prakruti* , *Agni* , *Koshtha* , *Doshik* dominance in its संप्राप्ति etc. which could support the concept of *Tamakshwasa* being आमाशयसमुद्भव (पित्तस्थानसमुद्भव) which could ultimately support Concept of *Mahasrotas* as *Moolsthana* of *Pranavaha Srotas* .

5. Analysing serum Serotonin levels in *Vegavstha* and *Avegavstha* of *Tamakashwasa* as it is found to be prime Immuno-modulator in Respiratory system secreted by cells in the gut .

'*Sru sarati*' means to flow , to exude , to ooze , to filter , to permeate . By etymology "*srotas*" is what , **within which something flows or carried** .

Srotas is the functional channel within the living body , concerned with one exclusive vital function , can be visible or non-visible which is the base of transformation of nutrients in biological elements , being the metabolic centre of that particular *Dhatu* , transport of nutrients and waste products .

***Srotas* are micro or macro spaces in the body which carry the different biochemical molecules during the process of metabolism .**

The internal transport system of the body , represented by *Srotas* , has been given a place of fundamental importance both in state of health and disease .
Structural and functional integrity of these *Srotas* is needed in order to maintain normal physiology , likewise impairment in this integrity can lead to pathological states .

" प्रभव स्थानं " means the site of its origin or site of its birth or the site of its very beginning .

With the context to *Srotas* , *Moolsthana* of the *Srotas* is प्रभव स्थानं means its site of origin or metabolic centre of that particular biological element .

Chakrapani* has described *Moolsthana of Srotas* as *Prabhav sthana means the anatomical seat of respective *Srotas* . But it also can be main seat of pathology of that *Srotas* or principle seat of manifestation of the diseases of that *Srotas* .

The cause of morbidity of *Srotas* and their manifestations first strikes the *Moolsthana* of the respective *Srotas* . This morbidity slowly spreads throughout the body by Law of functional connectivity .

Moolsthana of any *Srotas* can be categorised as *Utpattisthana* - seat for origin of that element (*Dhatu* / *Mala* etc.) , *Sangrahasthan* - seat for storage , *Vahansthana* - seat of carriage or flow of bodily elements , *Naidanik sthana* - *Moolsthana* having diagnostic importance or *Chikitsatmak sthana* - *Moolsthana* important in treatment of certain *Srotas* .

Moolsthana of any *Srotas* may be under one of the above mentioned category or in combination but their clinical applications are common in all categories .

Because they are interdependent , health and wellbeing of one channel has potentially governing or controlling effect on the other channels too .
The concept of *Moolsthana* is extension of the understanding of the concept of *Srotas* . *Moolsthan* of any *Srotas* can be anatomically different than the *Srotas* itself as its centre of control .

The origins which are under the category *Naidanik sthana* or *Chikitsatmaka sthana* might not be necessarily anatomically same as the *Srotas* . These kind of origins or *Moolsthana* are physiological governing centres and should be interpreted accordingly .

***Moolsthana* of *Pranavaha Srotas* :**

According to *Acharya Charak Hriday* and *Mahasrotas* , according to *Acharya Sushrut Hriday* and *Dasha dhamani* carrying *Prana* and according to *Acharya Sharangadhara Nabhi* is the *Moolsthana* of *Pranavaha srotas* .

- ***Hriday Moolsthana* as *Vahanasthana* :**

***Hriday* (thoracic heart) is associated with the actual gaseous exchange between external & internal air so can be interpreted as *Vahanasthana* .**
Pranavayu initiates it's impulse from '*Shiras*' and travels till '*Uras*'(chest) enabling intake of air .

- ***Hridaya* as *Naidanik* type of *Moolsthana* :**

***Hridaya* can also be considered as *Naidanik* type of *Moolsthana* of *Pranavaha Srotas* ;** as *Acharya Charak* mentions *Hridroga* originating from *Shramashwas* or *Kasadharana* (withholding *Shramashwasa* / *Kasa*-cough) and also '*Kasa*' and '*Shwasa*' are cardinal symptoms of *Hridroga* .

***Acharya Sushrut* also consider *Hriday* as *Moolsthana* of *Pranavaha Srotas* . If we consider it *Mastishksthit Hriday* , immunomodulatory role of Serotonin which itself is a neurotransmitter , in Respiratory system becomes significant . Because Serotonin concentration is directly related with clinical severity of *Tamakashwasa* .**

Acharya Charak describes all disturbed lung functions in *Pranavaha Srotodushti Lakshanas* , and mentions these should be treated as the treatment guideline or principle of *Shwasa* .

- ***Nabhi* as the *Moolsthana* of '*Pranavaha Srotas*' according to *Acharya Sahrangadhara* :**

Kinesiology of Thoracic and Abdominal Cavities and *Ayurvediya* interpretation of *Nabhi* as a *Moolsthana* of *Pranavaha Srotas* :

In the process of respiration along with heart and lung machine , diaphragm and other major thoracic and abdominal muscles play a major role in smooth functioning of *Pranavaha Srotas* i.e. process of respiration .

Nabhi comprises naval region with the abdominal muscles and diaphragm . **Diaphragm with it's great contractility enables the functions of *Prana* and *Udana* i.e. taking air (*Prana*) inside the body (*Nishwas*) and expelling it out of body by *Udana* (*Uchhwasa*) .** Anatomically , diaphragm divides body into two major cavities i.e. thoracic and abdominal . **The Diaphragm is the muscle which equilibrates the pressures from both the cavities - thoracic and abdominal .**

Any mechanical disturbance in this , disturbs act of respiration and movements in abdominal organs as well . **Thus pressured diaphragm creates mechanical disturbance in the movements of respiration . With this understanding one can understand the view of *Acharya Sharangadhara* considering *Nabhi* as *Moolsthana* of *Pranavaha Srotas* .**

If *Nabhi* is interpreted as umbilicus this explanation gives insight in considering it as *Moolsthana* of *Pranavaha Srotas* as *Niyamana sthana* .

- **" *Mahasrotas* " As " *Moolsthana* " Of " *Pranavahasrotas* " With Context To " *Tamakashwasa* " :**

According to *Charak Samhita* "*Mahasrotas*" is the "*Moolsthana "* of *Pranavaha Srotas* . ***Acharya Charak* has also very clearly considered *Shwasa* or Bronchial Asthma as *Aamashayottha Vyadhi* i.e. its pathology originating from *Aamashaya* . *Acharya Charak* being from school of Physicians , has focussed on treatment perspective and origin of pathology rather than anatomical perspective .**

Kinesiology or dynamics of *Mahasrotas* or gastrointestinal tract greatly influence dynamics of Respiratory and Cardiovascular Systems as discussed earlier .
***Acharya Charak* has defined *Amashaya* spreading from *Nabhi* to *Stana* i.e. the area between umbilicus to breast comprising the whole digestive system .**
***Chakrapani* explains that upper part of *Amashaya* which is seat of *Pitta* or *Agni* , has to be considered as seat or origin of pathology of *Tamakshwasa* .**

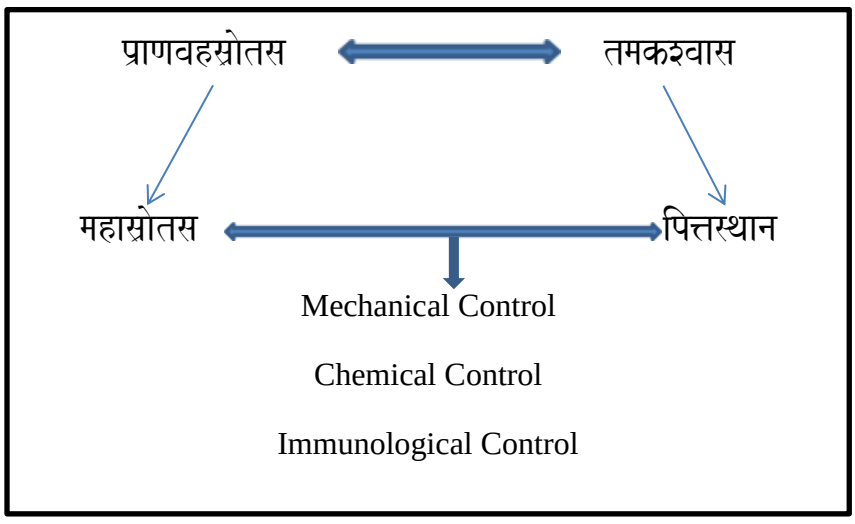
Thus *Tamakashwasa* disease of respiratory system is said to be originated from '*Pittasthana*'. Though the syptoms of *Tamakashwasa* are *Kapha-Vatatmaka* , *Pittasthanadushti* and *Pittadushti* is predisposing in *Samprapti* of *Tamakashwasa* .

Clinically , symptoms like abdominal distention (*Anaha*) , constipation (*Malavashtambha*) , eructation (*Udgar*) , flatulence (*Atopa*) and regurgitation or acid reflux are closely associated with *Vegavstha* of *Tamakshwasa* .

Food can also provoke airway reactivity . Food challenge has been shown to elicit wheezing in small proportion . Gastrointestinal reflux is a significant provocating factor in asthma .

Bronchus Associated Lymphoid Tissues (BALT) and Gut Associated Lymphoid Tissues (GALT) have numerous common morphological and functional characteristics .
Overlapping pathological features are described in literature between body's lungs , airways and stomach , small intestines , underlines strong connection between two having same pathophysiological pathway .
These findings also strongly supports the concept of *Tamakashwasa* being '*Pittasthansamudbhava*'.

Flow Chart [1]



The study done for this thesis work regarding *Moolsthana* of *Pranavaha Srotas* reveal observations which help to assess the relation between *Mahasrotas* i.e. GI tract and *Pranavaha Srotas* i.e. Respiratory system with respect to *Tamakashwasa* as shown in the above flowchart .

Mahasrotas is *Moolsthana* of *Pranavaha Srotas* and upper part of *Aamashaya* or *Mahasrotas* ie. *Pittasthana* is the pathological seat of *Tamakshwas* .

Pranavaha Srotas is controlled by *Mahasrotas* in three ways Mechanical control (Pressure balance between thoracic and abdominal cavities) , Chemical control (Maintaining pH in GI tract preventing acid reflux or regurgitation provoking bronchospasm) or Immunological control (Secreting Serotonin which is a key immunomodulatory in inflammatory changes in bronchi) .

***Nidanpanchak of Shwasa* :**

***Hetu* :**

अतीसारज्वरच्छर्दिप्रतिश्यायक्षतक्षयात् □

रक्तपित्तादुदावर्ताद्विसूच्यलसकादपि □१३ □

पाण्डुरोगाद्विषाच्चैव प्रवर्तेते गदाविमौ □

निष्पावमाषपिण्याकतिलतैलनिषेवणात् □१४ □

पिष्टशालूकविष्टम्भिविदाहिगुरूभोजनात् □

जलजानूपपिशितदध्यामक्षीरसेवनात् □१५ □

अभिष्यन्द्युपचाराच्च श्लेष्मलानां च सेवनात् □

कण्ठोरस□प्रतीघाताद्विबन्धैश्च पृथग्विधै□□१६ □ *Charak Samhita Chikitsasthana* 17/ 13 to 16

कासवृध्दया भवेत् श्वास□पूर्वैर्वा दोषकोपनै□□

आमातिसारवमथुविषपाण्डुज्वरैरपि □

रजोधूमानिलैर्मर्मघातादतिहिमाम्बुना □ अष्टांगहृदय निदानस्थान अध्याय ४ सूत्र १□

Atisaar , Jwara , Chardi , Pratishyay , Kshatkshaya , Raktapitta ,Udavarta , Visuchika , Alasaka , Pandu , Visha & different *Doshaprakopaka Ahaar sevan* can cause *Shwasa* and *Hikka* both . (*Charak Samhita*)

Bhaarvahan , Adhwa , Ativyayam , Vegadharana , Apatarpana are *Hetu* described by *Sushrutacharya* .

Raja , Dhooma , Anil , Shitapaan & *Marmaghat* are also causative factors of *Shwasa* according to *Vagbhat* .

Disequilibrium in abdominal and thoracic cavities due to *Udavarta , Chardi* are predisposing factors for *Shwasa* . In the process of respiration , diaphragm and other major thoracic and abdominal muscles play a major role in smooth functioning of *Pranavaha Srotas* . Diaphragm with it's great contractility enables the functions of *Prana* and *Udana* i.e. taking air inside the body (*Nishwas*) of *Prana* and expelling it out of body by *Udana* (*Uchhwasa*) .

Pressured diaphragm creates mechanical disturbance in the movements of respiration .

Acidic pH of stomach , regurgitation of acid (GERD) are also known predisposing factors of bronchospasm .

***Hetus* described by *Aacharya Vagbhat* are purely causes creating allergic bronchospasm .**

***Poorvaroop* :**

आनाह□पार्श्वशूलं च पीडनं हृदयस्य च □

प्राणस्य च विलोमत्वं श्वासानां पूर्वलक्षणम् □□*Charak Samhita Chikitsasthana* 17/ 20

प्रागूपं तस्य हृत्पीडा भक्तव्देषोऽरतति□रा□□

आनाह□पार्श्वयोशूलंवैरस्यं वदनस्य च □१६ □□*Sushrut Samhita Uttartantra* 51/ 6

प्रागूपं तस्य हृत्पार्श्वशूलं प्राणस्य विलोमता □□

आनाह□शंखभेदश्च □□*Ashtang Hriday Nidansthana* 4/4,5

Aanah , *Parshwashul* , *Hridaypida* , *Viloman* of *Prana* , *Vaktravairasya* , *Shankhanistoda* are prodromal symptoms of *Shwasa* .

All prodromal symptoms show disturbed abdomino- thoracic pressure , reverse peristalsis , pressured diaphragm . So dynamics of GI tract seems to have profound influence over dynamics of Respiratory System .

***Roop* :**

Ghurghuraka - wheezing sound or murmuring sound , *Prana shwasaprapidaka* - dyspnoea of exceedingly deep velocity which is life threatening , *Pramoha* & *Gacchati Muhurmuhu* - because of acute spasms ,the patient gets tremors and coughs , become static , he faints while coughing , Since the phlegm does not come out (drained properly) , *Bhavati Dukkhitah* - he becomes restless , *Kanth udhwasana* - his throat is choked and he is unable to speak freely , *Na Labhate Nidra* - he is unable to sleep, as he gets dyspnoea while lying down for sleep , *Ucchritaksha* - eyeballs project out side , *Lalat swidyate* - sweating on forehead and becomes restless , *Vishushka Asya* - his mouth becomes dry , he gets frequent paroxysms dyspnoea . This is the symptomatology described in *Charak Samhita* . Other treatises describe almost same *Lakshanas* .

This symptomatology of *Tamakshwasa* describes moderate to severe intensity of bronchospasm with all other details of attack of bronchospasm .

***Samprapti* :**

1) *प्रतिलोमं यदा वायु□स्त्रोतांसि प्रतिपद्यते □*

ग्रीवाशिरश्च संगृह्य श्लेष्माणं समुदीर्य च □□

करोति पीनसं तेन □द्धो घुर्घुरकं तथा □

अतीवतीव्रवेगं च □ासं प्राणप्रपीडकम् □□Charak Samhita , sixth section 17th chapter / 55 ,56

2) विहाय प्रकृतिं वायु: प्राणोऽथ कफसंयुत : □

श्वासयत्यूर्ध्वगो भूत्वा तं श्वासं परिचक्षते □□□सुश्रुतसंहिता उत्तरतंत्र ५१ /४

Pranavayu leaves its normal course ie. upwards and becomes *Pratilom* . It catches neck and head and provokes *Kapha* which gives rise to choking in respiration and bronchospasm leading to peculiar wheezing sound .

3) *कफोप□द्धगमन□भवनो विष्वगास्थित□□*

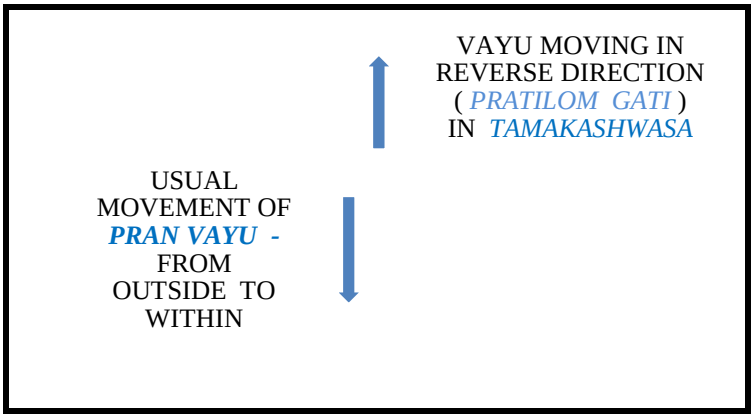
प्राणोदका□वाहिनी दुष्ट□स्रोतांसि दूषयन् □

उरस्थ□कु□ी श्वासं आमाशयसमुद्भवम् □अष्टांगहृदय निदानस्थान अध्याय ४ सूत्र ३□

By choking throat by *Kapha* , *Vayu* gets vitiate and further vitiates *Prana* , *Udaka* & *Anna vahi srotas* giving rise to *Shwasa* . *Shwasa* is believed to be *Aamashaysamudbhav vyadhi* .

In *Samprapti* of *Shwasa Pranavayu* gets upward direction unlike its usual downward one so it vitiates and irritates the Respiratory tract leading to hypersecretion of Kapha , cough , cold and ultimately Bronchospasm giving wheezing sounds .

Flow chart [2] *TAMAKASHWASA SAMPRAPTI* :



Two factors in the *Samprapti* of *Tamakashwasa* are important :

1) *Prana Udaka Annavahi Srotodushti*

2) *Amashayasamudbhava*

Symptoms like *Atisrushtam* , *Atibaddham* , *Sashabdam* , *Sashulam* , *Alpalpam* (*Pratilom Gati* of *Vayu*) breathing relates *Tamakashwasa* with *Pranavaha Srotodushti* .

In Literature search it has been found the interrelation of GALT and BALT . Both the respiratory tissues (BALT) and gut associated mucosal surface (GALT) have numerous common morphological and functional characteristics , with the mucosal immunological system believed to be one such common feature . **Overlapping pathological features are described in literature between body's lungs , airways and stomach , small intestines , underlines strong connection between two having same pathophysiological pathway** .

This can be correlated (though not one to one) with *Udakavaha Srotodushti* considering *Udaka , Rasa* & *Kapha* having similar attributes though *Udakavaha Srotas* is interpreted differently .
Annanabhilasha , Arochak , Avipak , Cchardi are the symptoms of *Annavaha Srotodushti* which are seen either as *Poorvaroop* or *Roop lakshana* of *Tamakashwasa* .

Mahasrotas **is interpreted as the space or** ***Koshtha*** **and been divided into** ***Amashaya*** **and** ***Pakwashaya*** **.** ***Tamakshwasa*** **disease of** ***Pranavaha Srotas*** **is a disease believed to be originated from** ***Pittasthana*** **.** ***Chakrapani*** **(commentator of** ***Charak Samhita*** **) interprets** ***Pittasthana*** **as upper part of** ***Amashaya*** **i.e. digestive system which is the seat of** ***Pitta*** **.**

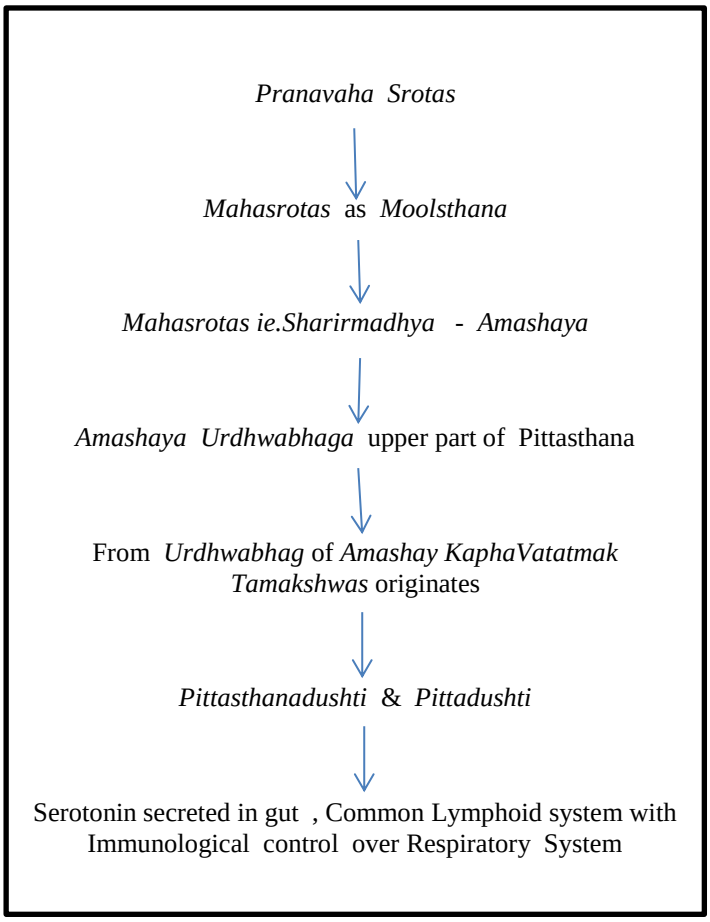
Actual according to study in this thesis many findings suggest that ***Tamakshwasa*** **is predisposed or triggered by** ***Pittprakopak Hetu*** **.** ***Pitta Prakruti , Rutu*** **having** ***Pitta dominance*** are more prone to get *Tamakshwasa* and its exacerbation . *Pittapradhana Poorvaroop , Roop Lakshana* were more observed in patients .

These findings backs the postulation of *Mahasrotas* ie. *Amashaya* and *Pittasthana* ie. upper part of *Amashaya* play key role in *Tamakashwasa Samprapti* .

Overlapping pathological features described in literature between body's lungs , airways and stomach closely relates with *Pittasthanadushti* which is root of *Tamakashwasa Samprapti* .

So interpretation of *Samprapti* of *Tamakshwasa* considering *Mahasrotas* as *Moolsthana* will be as following .

Flow Chart [3]



***Upashaya* :**

1) *आसीनो लभते सौख्यंमुष्णं चैवाभिनन्दति* □

मेघाम्बुशीतप्रावातै□श्लेष्मलैश्चाभिवर्धते □

स याप्यस्तमक□श्वास□/□ *Charak Samhita Chikitsasthana* 17 chapter , 60, 62

2) *श्वासी काङ्क्षत्युष्णं सवेपथु□/□*

मेघाम्बुशीतप्रावातै□ श्लेष्मलैश्च विवर्धते □

स याप्यस्तमक□साध्यो नवो वा बलिनो भवेत् □ *अष्टांगहृदय निदानस्थान अध्याय ४ सूत्र ९□१०*

Patient is relieved by sitting rather than sleeping in supine position .

Clouds , rains , cold and wind exacerbate spasm increasing phlegm .

He craves or likes hot comfort .

In the study it was also observed that fullness and emptiness of stomach holds importance in exacerbation of bronchospasm . Of course it depends on subject to subject and also have close positive relation with *Dhoshaprakopaka Hetusevana* .

OBSERVATIONS AND RESULTS :

1.*Prakriti*

In **'*Prakriti*' wise distribution** majority number of individuals were having Prakriti which had ***Pitta* as first or second dominant which backs the principle , *Tamakashwasa* being *Pittasthanasamudbhava*** (*Vata – Pitta Prakruti* 30% , *Vata – Kapha Prakruti* 13% , *Pitta –Kapha Prakruti* 54% *Vata* 2% , *Kapha* 1%)

2.*Agni*

In *Agni* wise distribution **almost 40% population was having *Mandagni*** .

Rest of the population was having either ***Tikshnagni* 28 %** or ***Vishamagni* 25%** .

3.Relation of exacerbation with *Rutu*

Generally *Tamakshwasa* exacerbation is observed in some particular *Rutu* having natural dominance of certain *Dosha* .

Though maximum number of population was having exacerbation in *Hemant Shishir Rutu* (22) , significant number of individuals were having tendency to have **exacerbation in *Pitta* dominated *Rutu*** i.e. ***Sharad* ,*Varsha* , *Greeshma*** (***Varsha* /*Sharad*** *Rutu* 17, ***Sharad* / *Greeshma*** *Rutu* 16 , *Hemant* /***Varsha*** *Rutu* 13 , ***Sharad* /** *Vasant Rutu* 7 , *Hemant* / *Shishir* /*Vasant*/ *Sharad* 5 , ***Varsha*** / *Shishir Rutu* 4 , ***Varsha* /** *Vasant* 3) .

***Hemant* and *Shishir rutu* helps *Sanchay* (accumulation) of *Kapha* also because of dryness in atmosphere in these *rutus* further vitiates *Vata* too . Vitiated *Vata* and *Kapha* both leads to *Shwasa Samprapti* .**

4.Relation of Bowel habits with exacerbation of bronchospasm

Among sample , **39% individuals had positive relation between bowel habits (disturbed bowels - constipation , flatulence , bloating etc.)** and 61% individuals showed no relation with altered bowel habit **with exacerbation of bronchospasm .**

Serum Serotonin analysis was done in subjects having positive relation with exacerbation of bronchospasm . Mann Whitney U statistics was used for analysis and P value is < 0.0001 , with 1235.5 (Mann Whitney Statistics) & 3525.5 (U) which is significant . So individuals showing positive relation with bowel habits also reflects positively in Serotonin concentration .

So bowel habits predisposing or exacerbating *Shwasa vega* also show positive uplift in serum serotonin concentration . This finding strengthens the concept of *Mahasrotas* being *Moolsthana* of *Pranavaha Srotas* .

5.Presence of gastro-intestinal symptoms before / during exacerbation of bronchospasm :

Among total 7 number of Gastrointestinal Symptoms **maximum number of individuals were having GI symptoms before / during exacerbation of bronchospasm** (4 symptoms present 34% , 5 symptoms present 47% , 6 symptoms present 12%) , number of individuals having 3 number of symptoms , less than 3 and minimum and maximum number of symptoms were negligible in number (1 symptom present 0% , 2 symptoms present 0% , 3 symptoms present 6% , 7 symptoms present 1%).

This underlines the kinesiological connection between two systems which get affected by each other .

Serum Serotonin levels in subjects having Gastrointestinal symptoms like bloating , acidity , indigestion during or before having attack of Bronchospasm , were subjected to analysis . **Mann Whitney U statistics was used for analysis and P value is < 0.0001 , with 1064 (Mann Whitney Statistics) & 3628 (U) which is significant .**

It again indicates that the symptoms related to GI tract during or before *Shwasa vega* have positive relation to Serum Serotonin concentration . Mostly these symptoms are described as *Poorvaroop* . So we can infer that Serum Serotonin concentration is significant in the subjects having full flared *Poorvaroop* .

6. Distribution of sample showing no of ***Poorvaroop Lakshana*** among total 6 . 2 symptoms present in 7% , 3 symptoms present in 41% , 4 symptoms present in 40% , 5 symptoms present in 12% , no individual was having minimum 1 or maximum 6 symptoms . Most Poorvaroop are related to Gastrointestinal system like bloating , acidity , indigestion etc. They indicate disturbed GI dynamics as well as altered pH .

7. Distribution of sample showing no of ***Roop Lakshana*** among total 6 .
0-5 symptoms were present in 46 % , 6-10 symptoms were present in 54 % and no individual was having above 10 symptoms .

8.*Doshaprakopak Hetusevan* by patients

Patients tend to have number of *Doshaprakopak Hetusevan* .
Prakopak Hetusevan done maximum of the *Dosha* and also it's magnitude in terms of number of *Hetusevan* is obtained by analysis .

Certain intervals of number of *Hetus* consumed were considered i.e. 0-5 , 6-10 , above 10 . At each interval / range of number of *Doshaprakopak Hetusevan* of all three categories were compared to each other .

Analysis shows that patients maximally did *Kapha* and *Vata Prakopak Hetusevan* upto 0-5 number . ***Pitta Prakopak Hetusevan* was less than these two but with more magnitude than moderate level .**

6-10 number of *Hetus* were consumed by patients which aggravate *Vata* and *Pitta* . Among that *Pitta Prakopak Hetus* were consumed by maximum number of individuals .

No individual consumed any *Prakopak Hetusevan* which was more than 10 in number .

Here in moderate to border line high range of *Doshaprakopak Hetusevan* , *Pitta Prakopak Hetus* were consumed maximally .

***Kapha* and *Vata Prakopak Hetusevan* was in maximum though which ushers *Tamakashwasa Samprapti* .**

9.*Pranavaha* and *Annavaha Srotodushti*

In *Pranavaha Srotodushti Lakshana* around 55% individuals showed more than 50% symptoms , of total described .

Whereas in *Annavaha Srotodushti Lakshana* almost 80% people showed more than 50% symptoms , of total described .

So it shows that **in *Pranavaha srotodushti* , significant percentage of patients had *Annavaha Srotodushti* along with which signifies physiological interdependence of both systems in diseased condition .**

10. Serotonin Levels estimated by ELISA :

Serum Serotonin levels in *Avegavastha* and *Vegavastha* in 100 patients of *Tamakshwasa* were estimated by ELISA method .

Following is the statistical analysis of values obtained :

P value = 0.0001 , it is extremely significant.

Mean Difference = 137.11

C.I. is 95% (93.982, 180.23) but since the data failed the normality test with p =0.0062, we applied the **Wilcoxon Signed Rank test** .

Hence we could conclude that there was a significant increase in serum Serotonin level during the spasm (*Vegavastha*).

By analysing the qualitative and quantitative parameters included in the CRF , following factors emerge as follows :

1. Sample individuals were more of having *Prakriti* either first or second with dominance of *Pitta Dosha* .
2. Averagely most patients were having *Mandagni* which facilitates disease process .
3. Though *Tamakashwas* is a chronic condition , it's been observed pathophysiology of disease becomes aggressive in certain *Rutu* taking advantage of natural dominance of *Dosha* . Observation in the study suggest that natural *Pitta Dosha* dominance by *Rutu* is more prevalent in majority of patients .
4. Almost 39% of patients showed disturbed GI functions in form of constipation , flatulence , bloating etc. during exacerbation of bronchospasm .
5. *Pitta Prakopak Hetus* were consumed by maximum number of individuals .
6. Maximum number of individuals were having Gastro-Intestinal symptoms before / during exacerbation of bronchospasm .

7. When the two *Srotodushti Lakshanas* were compared in *Pranavaha srotas & Annavaha Srotas* , significant percentage of patients have *Annavaha Srotodushti* along with *Pranavaha Srotodushti* was observed .
8. Serum Serotonin levels in same set of patients were compared in *Vegavastha* and *Avegavastha* , significant rise in Serotonin level was observed in *Vegavastha* .
9. *Pittasthanadushti* and *Pittadushti* are prevalent in significantly high number of subjects .

From all the above factors in *Tamakashwasa* patients , when analysed it is very predominantly observed that pathophysiology of *Tamakshwas* is greatly influenced by *Pitta* dominant *Prakriti* , *Rutu* , consumption of *Pitta Prakopak Hetus* .

Likewise wellbeing of Respiratory system is closely dependant on wellbeing of GI tract . Concomitant disturbance of GI tract (in form of altered motility , other GI symptoms like acid reflux , flatulence , bloating etc.) with bronchospasm suggest a strong pathophysiological connection between two apparently different systems .

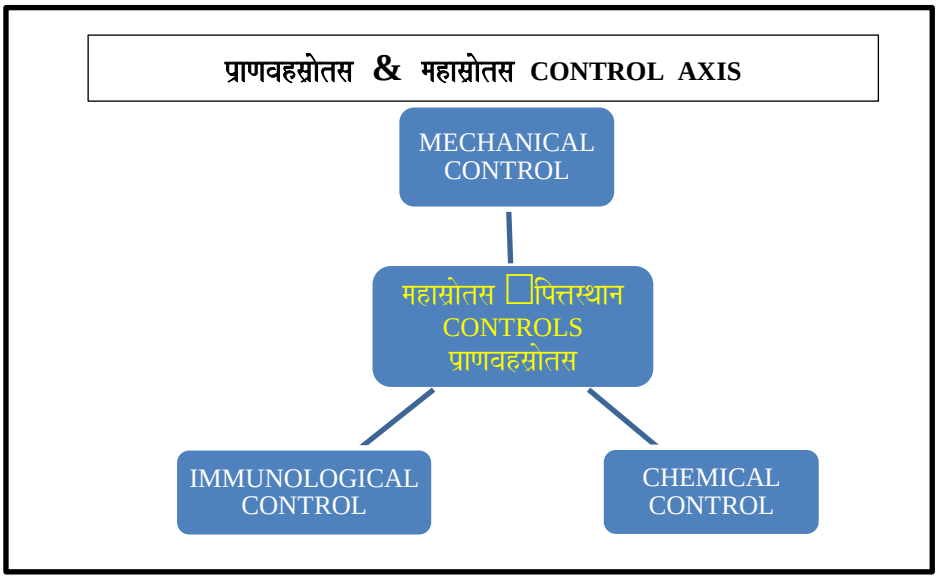
Elevated Serum Serotonin levels in *Vegavastha* of *Tamakashwasa* supports the concept of *Tamakshwas* being originated from *Pittasthana* i.e. *Pittasthanasamudbhava* .

Serotonin is a neurotransmitter secreted by entero-chromaffin cells in Gut flora , also plays a major role in governing Immunological Cascade in Respiratory system .

Serotonin is secreted by enterochromaffin cells and get accumulated in platelets . By allergen challenge this Serotonin from platelets get secreted and has a stimulatory effect on release of IgE and other important cytokines and inflammatory mediators released by different cells in Respiratory System . Serotonin influences the Immunological mechanism in Respiratory system and also inflammatory mechanisms on allergen challenge .

Thus Gastrointestinal Tract has different aspects of function which seems to influence the normal physiology of Respiratory system .

Flowchart [4]



GI tract seems to have three way control over respiratory system :

Mechanical Control - Maintain gastric motility , prevent Gastric reflux etc. Symptoms like gastric distention , flatulence , constipation , reverse peristalsis are common during or around asthmatic attack which mechanically disturbs functioning of respiratory system .

Chemical Control - Maintaining pH of GI tract especially stomach . Gastric pH is another vital factor influencing functioning of respiratory system as gastric acid reflux is known to elicit bronchospasm .

Immunological Control – As elaborately discussed earlier Serotonin secreted by Entero-chromaffin cells of GI tract have strong influence in Immunological and Inflammatory reactions of Respiratory parenchyma . In the airway inflammation of asthma , the airway wall is infiltrated by T lymphocytes , eosinophils and mast cells. All these cells get stimulated for the further secretion of inflammatory cytokines through the medium of Serotonin .

Serotonin plays a key role in initiating this changes by influencing Ig E secretion . Exposure to allergen favour the synthesis of IgE , the binding of IgE results in immunologically specific sensitization of mast cells , monocytes/macrophages , eosinophil & basophils . These cells elaborate mediators of inflammation , into the local microenvironment leading to the airway inflammation of asthma .

Thus considering *Mahasrotas* as *Moolsthana* of *Pranavaha Srotas* could have multiple facets of interpretation adding new insights in the fundamental concept .

CONCLUSION

Majority number of individuals were having *Prakriti* which had ***Pitta*** **as first or second dominant.**

Significant number of individuals were having tendency to have **exacerbation in *Pitta* dominated *Rutu*** i.e. ***Sharad* ,*Varsha* , *Greeshma*** .

Among total 7 number of Gastrointestinal Symptoms **maximum number of individuals were having GI symptoms before / during exacerbation of bronchospasm** .

Analysis of Serum Serotonin concentration in subjects having positive relation of GI symptoms with bronchospasm revealed significant increase . Serum Serotonin concentration also found significantly increased in individuals having altered bowel habits .

Pitta Prakopak Hetus **were consumed by maximum number of individuals before or around exacerbation .**

In *Pranavaha srotodushti* , significant percentage of patients had *Annavaha Srotodushti* along with .

Serum Serotonin levels in same set of patients were compared in *Vegavastha* and *Avegavastha* , statistically significant rise in Serotonin level was observed in *Vegavastha* .

From all the above factors in asthmatic patients , when analysed it is very predominantly observed that **pathophysiology of *Tamakshwas* is greatly influenced by *Pitta* dominant *Prakriti* , *Rutu* , consumption of *Pitta Prakopak Hetus* . These findings strongly supports the concept of *Tamakashwasa* / Asthma being *Amashaya* and '*Pittasthansamudbhava*'.**

Likewise **wellbeing of Respiratory system is closely dependant on wellbeing of GI tract** . Concomitant disturbance of GI tract (in form of altered motility , other GI symptoms like acid reflux , flatulence , bloating etc.) with bronchospasm **suggest a strong pathophysiological connection between two apparently different systems .** Elevated Serum Serotonin (which has immunological control over pro inflammatory cytokine cascade in bronchi) levels in *Vegavastha* of *Tamakashwasa* may support the concept of *Tamakshwas* being originated from *Pittasthana* i.e. *Pittasthanasamudbhava* .

Association or interdependence of Respiratory system and GI System seems to be in three ways -

Mechanical Control - Maintaining gastric motility , prevent Gastric reflux etc.
Chemical Control - Maintaining pH of GI tract especially stomach and maintaining secretary equilibrium .

Immunological Control - Serotonin secreted by Entero-chromaffin cells of GI tract have strong influence in Immunological and Inflammatory reactions of Respiratory parenchyma .

Thus Gastrointestinal Tract has different aspects of function which seems to influence the normal physiology of Respiratory system .

Two factors in the *Samprapti* of *Tamakashwasa* are important :

1) *Prana Udaka Annavahi Srotodushti*

2) *Amashayasamudbhava*

Symptoms like *Atisrushtam , Atibaddham , Sashabdam , Sashulam , Alpalpam* (*Pratilom Gati* of *Vayu*) breathing relates *Tamakashwasa* with *Pranavaha Srotodushti* .

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This can be correlated (though not one to one) with *Udakavaha Srotodushti* considering *Udaka , Rasa* & *Kapha* having similar attributes though *Udakavaha Srotas* is interpreted differently .
Annanabhilasha , Arochak , Avipak , Cchardi are the symptoms of *Annavaha Srotodushti* which are seen either as *Poorvaroop* or *Roop lakshana* of *Tamakashwasa* .

***Mahasrotas* is interpreted as the space or *Koshtha* and been divided into *Amashaya* and *Pakwashaya* . *Tamakshwasa* disease of *Pranavaha Srotas* is a disease**

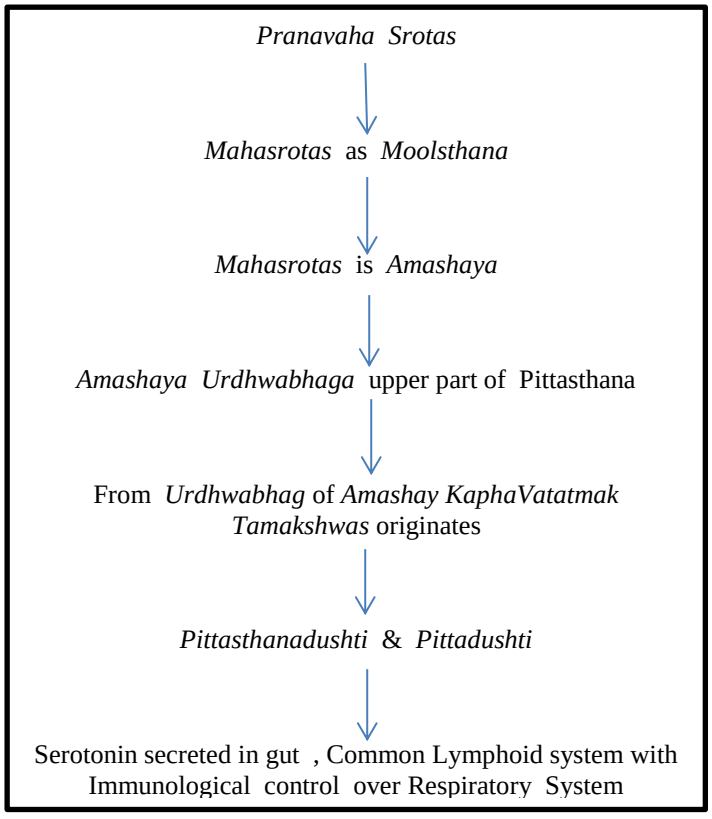
believed to be originated from *Pittasthana* . *Chakrapani* (commentator of *Charak Samhita*) interprets *Pittasthana* as upper part of *Amashaya* i.e. digestive system which is the seat of *Pitta* .

Actual according to study in this thesis many findings suggest that *Tamakshwasa* is predisposed or triggered by *Pittprakopak Hetu* . *Pitta Prakruti* , *Rutu* having *Pitta dominance* are more prone to get *Tamakshwasa* and its exacerbation . *Pittapradhana Poorvaroop* , *Roop Lakshana* were more observed in patients .

These findings backs the postulation of *Mahasrotas* ie. *Amashaya* and *Pittasthana* ie. upper part of *Amashaya* play key role in *Tamakashwasa Samprapti* .

Overlapping pathological features described in literature between body's lungs , airways and stomach closely relates with *Pittasthanadushti* which is root of *Tamakashwasa Samprapti* .

So interpretation of *Samprapti* of *Tamakshwasa* considering *Mahasrotas* as *Moolsthana* will be as following .



Thus from the study and relevant references found in literature suggest that , though considering *Mahasrotas* as *Moolsthana* of *Pranvaha Srotas* by sage *Acharya Charak* sounds empirical , many supportive evidences are making their way by latest research based on more objective foundation .

***Ayurvedic* principles are more based on knowledge through clinical experience . Such objective evidences sharpens and redefines the wisdom in the ancient theories .**

FURTHER SCOPE FOR RESEARCH :

1) Serum Serotonin levels during exacerbation of *Tamakashwasa* could be done in larger sample size .

2) Serum Serotonin levels show elevation during exacerbation of *Tamakashwasa* so it could thought to be used as marker .

3) Serum Serotonin Levels can be studied in different *Ayurvedic* parameters like *Prakruti* , *Agni* , in different *Doshaprakopaka hetusevan* etc. in *Tamakashwasa* Patients .

4) Efficiency and action of *Rasayana* Drugs acting on *Pranavaha Srotas* eg. *Pippali* etc. can be tested using Serum Serotonin levels as marker .

5) Serum Serotonin levels can be used as marker in treatment of *Tamakshwasa* with *Panchakarma* like *Vaman* , *Virechan* .

6) The treatment principle तमके तु विरेचनम् □ can be verified by considering Serum Serotonin level as marker .

7) Fluctuations of Serum Serotonin concentration should be assessed in various *Ayurvediya* and other parameters like Sex , Age , *Prakruti* , *Agni* , *Rutu* of exacerbation , *Prakopak Hetu* etc .

8) Other *Srotas Moolsthana* which are not necessarily anatomical seats of that *Srotas* should be validated on basis of some experimental work . eg. *Vrukka* as *Moolsthana* of *Medovaha Srotas* , *Meda Moolsthana* of *Asthivaha Srotas* .
Some biochemical markers could be set for assessment of such *Srotas* .

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ID FORM

The study of Sharirkriyatmak importance of "Mahasrotas" as moolsthana of "Pranvaha srotas " with special reference to "Tamak Shwas"

Faculty of Ayurveda, Tilak Maharashtra Vidyapeeth, Pune – 37

Screening No. : Date of Assessment :

Volunteer's Signature : Time of Assessment :

Identification Form (ID Form)

This page will be filled for every volunteer included in the study ,and stored in a secure location .

Date of Enrolment : (DD/MM/YY) - ☐☐ ☐☐ ☐☐☐☐

Date of completion : (DD/MM/YY) - ☐☐ ☐☐ ☐☐☐☐

Name :

Date of birth :Age in years : ☐☐ ☐☐ ☐☐☐☐

Sex : (M-Male/ F-Female) ☐

Telephone No. :

Mobile No. : ☐☐☐☐☐☐☐☐☐☐

Address :

Email Address :

CONSENT FORM

The study of Sharirkriyatmak importance of "Mahasrotas " as moolsthana of "Pranvaha srotas " with special reference to " Tamak Shwas"

(Consent Form to be signed by the volunteer on the day of inclusion in the study.) Faculty of Ayurveda, Tilak Maharashtra Vidyapeeth, Pune – 37

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1. Volunteer's enrolment number :

2. Name of the Research Scholar :

3. Name of the Guide :

I hope to complete the study ,but I understand my participation is voluntary and that I am free to withdraw any time ,without giving reason and without my medical care or legal rights being affected.

I understand that the information will be used for medical research only and that will not be identified in any way in the analysis and reporting of the results .I understand that sections of any of my medical notes may be looked at by the sponsors or responsible person from the members of the IEC, Regulatory authorities if necessary .I give permission for these individuals to access to my records.

I understand what is involved in this trial and agree to take part in the clinical trial for the complete period .

Name of Volunteer :

Sign Date

Name of the Research Scholar :

Sign Date

Name of the Guide :

Sign Date

CRF 1

The study of Sharirkriyatmak importance of "Mahasrotas " as moolsthana of "Pranvaha srotas" with special reference to "Tamak Shwas"

Faculty of Ayurveda , Tilak Maharashtra Vidyapeeth , Pune – 37

---

1) Name of the Volunteer :

Date of Assessment :

Time of Assessment :

Age

Sex

Weight

2) Prakriti

3) Agni (Sama /Tikshna / Manda / Vishama

4) Kostha - Mrudu / Madhya / Krura

Bowel habits- constipation / any other GI disturbance

It's relation with exacerbation of bronchospasm if any

5) Desha

Kala (Rutu)

Bala

6) Symptomatology According to Classical Text :

Poorvaroop :

Hritpida - chest pain

Shula – chest pain

Adhmana - flatulance

Aanaha - abdominal distension

Vaktravairasya – bad taste in the mouth

Shankhanistoda - pricking pain in temporal region

Symptomatology during Vegavastha :

Peenasa – nasal secretion

Ghurghuraka - wheezing sound in lungs

Shwasa pranaprapidaka – shortness of breath which is suffocating

Pramoha – giddiness

Kasa – cough

Na labhate nidra – insomnia

Kantha udwasante - bad throat

Kruchra bhashita - difficulty in talking

Shayanah shwasa pidita - Difficulty in breathing in supine position

Aasino labhate saukhyam -Feel relieved after sitting

Ushnam abhinandati – Feel better with hot things (food /water etc.)

Lalaat swidyata - sweating over head

Vishushka aasya - dryness of mouth

7) Detail history of the patient regarding disease:

- Onset
- Frequency
- Exacerbation in which season
- Present medication
- With which medication patient is stable

8) General gastrointestinal symptoms and it's relation with exacerbation of the condition

- Relation with any food in particular
- Exacerbation empty stomach
- Exacerbation over eating
- Detail food history most frequent diet
- Bloating abdomen
- Acidity before / during attack
- Indigestion before / during attack

9) Detail food intake history regarding it's triggering action resulting in Tamaka Shwasa:

Food vitiating Vata (Vata prakopak Aahar)

Katu / tikta / kashay rasatmaka dravya

Bhel

Kurmure

Farsan

Chivada

Papad /Toast / Khakara

Popped cereals (lahya / pop corns etc.)

Readymade snacks (wafers etc.)

Vari / Nachani /any other kshudra dhanya

Abundant use of diacotyledons – vatana / chavali / tur / beans / chana

Kakadi / kalingad

Leafy vegetables – Alu / chuka / chakvat / ambadi /mula etc.

Toned milk / milk powder

Dried food

Instant / Ready to cook / Fast food

Any other

Exclusive Hetus of Shwasa given in Sushruta Samhita

Cold food and drinks (sheetpanashana)

Cold environment (sheet sthana)

Exposure to dust /smoke / sun and winds (raja /dhoom/aatap /anil sevan)

Over exertion due to physical exercise (vyayam)

Hard work(karma)

Weight lifting (bharvahana)

Travelling long distances on foot (adhwa)

Suppression of natural urges (vegavaghata)

Nutritional deficiencies (Apatarpana)

Trauma (Abhighat)

Vishamashana (taking food having opposite properties)

Samashana (taking simultaneously compatible and non compatible food)

Adhyashana (having food before digesting previous food)

Frequency of vata prakopak food

Strikingly exacerbation after having this food

Food vitiating Pitta (Pitta prakopak Aahar)

Katu /amla /lavana rasatmaka dravya

Peanuts

Deep fried / spicy food

Pickles

Buttermilk / Dahi

Kulith / mohari

Shevaga / mula / lasun / ale /mirachi

Dalchini / lavang / owa

Sea food

Bread / Bakery products

Fermented food (Idli /dhokala /all south Indian snacks)

Juices of sour fruits

Use of tamarind in food

Instant / Ready to cook / Fast food

Frequency of pitta prakopak food

Strikingly exacerbation after having this food

Food vitiating Kapha (Kapha prakopak Aahar)

Madhur /amla /lavana rasatmaka dravya

Udid

Wheat

Water chestnut (shingada)

Pohe (rice flakes)

Poppy seeds

Draksha /peru / kele /

Coconut

Fish / pork

Milk and milk products (paneer / khava / cheese / cream /ghee /butter / dahi etc.)

Sugarcane juice and it's products (jaggery / kakavi /sugar)

Instant / Ready to cook / Fast food

Frequency of kapha prakopak food

Strikingly exacerbation after having this food

10) Other history of patient :

- Hereditary history of Asthma
- Smoking
- Mental Stress
- Occupational reasons for the Asthma
- Specific Allergy to certain thing (food / smell/ chemical etc.)
- Intestinal Parasites (history of worms)

11) Examination of Pranavaha Srotas and Annavaha Srotas as part of Mahasrotas

1) Pranavaha Srotodushti Lakshana yes / no

Atisrushtam - intence breathing
Atibadham - choaking sensation while breathing
Kupitam - aggressive breathing
Alpalpam - short breathing
Abhikshanam – Increased rate of breathing
Sashabdam - breathing with wheezing sound
Sashul – breathing with pain

2) Annavaha Sroto dushti Lakshana yes / no

Anannabhilashana - Aversion for food
Arochaka - lack of taste in mouth
Avipaka - indigestion
Cchardi - vomiting

CRF 2 (INVESTIGATION FORM)

Clinical study of Sharirkriyatmak importance of "Mahasrotas" as moolsthana of "Pranvaha srotas" with special reference to "Tamak Shwas"

Faculty of Ayurveda, Tilak Maharashtra Vidyapeeth, Pune – 37

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1. Volunteer's enrolment number :
2. Name of the Research Scholar :
3. Name of the Guide:
4. **Groups :**

A) Group of patients included in the study of Tamaka shwasa in Avegavastha ☐

B) Group of patients included in the study of Tamaka shwasa in Vegavastha ☐

C) Selected Patients of Tamaka shwasa from Group A for Vamana kriya ☐

Investigative parameters :

100 patients of Tamaka Shwasa included in the study

No.	Name of Investigation	Normal values	During Avegavastha GROUP (A)	During Vegavastha GROUP (B)
1	Serotonin level			

GROUP (C) (10 patients selected from 100 patients in the study as vamanarha patients)

No.	Name of Investigation	Normal values	Before Vamana Before starting snehana	After Vamana After sansarjana krama
1	Serotonin level			

Sr No	Name	Age	Sex	WT	Prakriti	Agni	Koshtha	Season of Assessment
1	Ramjan Bi	45	F	54	Kapha vata	Manda	Madhyam	Shishir
2	Saifunnisa	28	F	55	Kapha	Manda	Krura	Shishir
3	Gajanan Bhandare	37	M	65	Vata Pitta	Manda	Madhyam	Shishir
4	Anil kumar	35	M	55	Vata	Manda	Mrudu	Shishir
5	Digambar Mhapankar	49	M	40	Vata	Manda	Madhyam	Shishir
6	Gaurav Morya	25	M	52	Pitta kapha	Tikshna	Mrudu	Shishir
7	Pramila Waghchaure	43	F	60	Kapha pitta	Manda	Madhyam	Greeshma
8	Devidas Patil	32	M	54	Pitta kapha	Manda	Madhyam	Varsha
9	Ashok Taksale	35	M	61	Pitta vata	Manda	Madhyam	Varsha
10	Ashok Chorage	40	M	58	Vata Pitta	Tikshna	Madhyam	Varsha
11	Krishna Sharma	32	M	62	Pitta vata	Tikshna	Madhyam	Varsha
12	Kiran Kadam	42	F	59	Pitta kapha	Tikshna	Mrudu	Varsha
13	Sachin Patil	26	M	54	Vata kapha	Visham	Madhyam	Varsha
14	Usha Giri	50	F	60	Kapha pitta	Manda	Madhyam	Varsha
15	Shankar	45	M	58	Kapha pitta	Manda	Madhyam	Varsha
16	Sharmi Goriwale	36	F	68	Kapha pitta	Manda	Mrudu	Varsha
17	Vithal Pawar	50	M	61	Kapha pitta	Manda	Madhyam	Varsha
18	Ganga	26	M	48	Vata Pitta	Tikshna	Madhyam	Varsha
19	Shantaram Ghag	48	M	65	Vata Pitta	Tikshna	Madhyam	Varsha
20	Sadashiv Hire	47	M	69	Kapha vata	Sama	Madhyam	Varsha
21	Rakamabai Metkar	50	F	60	Pitta vata	Sama	Mrudu	Varsha
22	Siraj Ahmad	42	M	58	Vata Pitta	Visham	Madhyam	Varsha
23	Baban Khamkar	48	M	60	Pitta kapha	Tikshna	Mrudu	Varsha
24	Koli	40	F	45	Pitta kapha	Visham	Krura	Varsha
25	Niyama Khan	24	F	50	Vata Pitta	Sama	Mrudu	Sharad
26	Jayramaiya S	43	M	71	Kapha pitta	Manda	Madhyam	Varsha
27	Bhagwan Londhe	41	M	52	Vata Pitta	Visham	Madhyam	Sharad
28	Abdul Rehman	35	M	56	Pitta kapha	Manda	Mrudu	Varsha
29	Rajaram Suryavanshi	39	M	70	Kapha pitta	Sama	Madhyam	Sharad
30	Shabnam shekh	44	F	65	Pitta kapha	Tikshna	Mrudu	Shishir
31	Pratibha Surve	46	F	68	Kapha pitta	Manda	Madhyam	Varsha
32	Urmila Pawar	40	F	70	Kapha pitta	Manda	Madhyam	Varsha
33	Manik Dakale	50	M	60	Kapha pitta	Manda	Madhyam	Sharad
34	Maruti Pipale	31	M	48	Vata Pitta	Visham	Krura	Varsha
35	Shankar Chavan	30	M	58	Kapha pitta	Manda	Madhyam	Varsha
36	Mangal Rane	50	F	68	Kapha pitta	Visham	Madhyam	Varsha
37	Suram Jadhav	47	M	62	Vata Pitta	Tikshna	Mrudu	Varsha
38	Sidhumala	43	M	72	Pitta kapha	Tikshna	Madhyam	Varsha
39	Priyanka Aiware	47	F	65	Vata Pitta	Visham	Krura	Sharad
40	Padma Avhad	39	F	57	Kapha pitta	Manda	Mrudu	Sharad
41	Sandeep Gaikwad	31	M	57	Pitta kapha	Tikshna	Mrudu	Sharad
42	Preeti Ghade	28	F	54	Pitta vata	Manda	Mrudu	Varsha
43	Shakuntala Shelar	50	F	60	Kapha pitta	Manda	Krura	Sharad
44	Shahu Datta	50	M	48	Vata Pitta	Manda	Krura	Sharad

45	Uday Chaugule	37	M	60	Pitta kapha	Visham	Madhyam	Sharad
46	Kamaruddin Ansari	42	M	69	Kapha pitta	Tikshna	Mrudu	Sharad
47	Prabhakar Waghmare	45	M	50	Pitta kapha	Manda	Madhyam	Varsha
48	Anant Shinde	43	M	48	Vata Pitta	Manda	Madhyam	Sharad
49	Sadashiv Hire	45	M	54	Vata kapha	Visham	Madhyam	Sharad
50	Vasant Vankar	38	M	60	Kapha vata	Visham	Madhyam	Sharad
51	Prakash Jain	47	M	69	Kapha pitta	Manda	Madhyam	Sharad
52	Ashok Chorage	45	M	55	Vata Pitta	Tikshna	Madhyam	Sharad
53	Rajendra Parab	36	M	60	Kapha vata	Manda	Madhyam	Sharad
54	Rohidas Shinde	36	M	58	Kapha pitta	Manda	Madhyam	Varsha
55	Anita Shinde	42	F	62	Kapha vata	Manda	Madhyam	Sharad
56	Mohamad	41	M	62	Kapha pitta	Visham	Madhyam	Sharad
57	Vithal Patil	42	M	54	Pitta vata	Tikshna	Mrudu	Sharad
58	Sumitra Thorat	50	F	68	Pitta kapha	Visham	Madhyam	Sharad
59	Yasin Umar	49	M	68	Kapha pitta	Manda	Madhyam	Sharad
60	Anjali Satyam	26	F	48	Pitta kapha	Sama	Madhyam	Sharad
61	Shraddha Tamble	39	F	52	Pitta kapha	Sama	Mrudu	Hemant
62	Shweta Tambade	50	F	52	Pitta vata	Tikshna	Mrudu	Sharad
63	Rajani Patil	35	F	45	Pitta Vata	Sama	Mrudu	Sharad
64	Sanjana Bhujbal	30	F	50	Pitta kapha	Sama	Mrudu	Sharad
65	Nagmani	38	F	62	Kapha pitta	Manda	Madhyam	Sharad
66	Vinay Singh	46	M	56	Pitta vata	Tikshna	Mrudu	Sharad
67	Manasi Mutalik	29	F	60	Pitta kapha	Visham	Madhyam	Sharad
68	Vasant Khedkar	40	M	60	Kapha pitta	Tikshna	Mrudu	Sharad
69	Suresh Thakur	45	M	68	Kapha pitta	Manda	Madhyam	Sharad
70	Vaishnavi Patil	28	F	67	Pitta kapha	Tikshna	Mrudu	Sharad
71	Leela Dasmana	50	F	70	Kapha pitta	Tikshna	Mrudu	Sharad
72	Anant Shinde	47	M	66	Kapha pitta	Tikshna	Madhyam	Sharad
73	Shankarmati	42	M	65	Pitta kapha	Visham	Madhyam	Sharad
74	Devidas Pawar	43	M	65	Kapha pitta	Manda	Madhyam	Sharad
75	Prabhakar Waghchaure	44	M	55	Vata Pitta	Tikshna	Krura	Sharad
76	Sonaram Thube	46	M	70	Pitta kapha	Visham	Krura	Sharad
77	Keshav Raut	22	M	57	Kapha vata	Manda	Madhyam	Sharad
78	Sayali Patil	25	F	70	Kapha pitta	Manda	Madhyam	Sharad
79	Manek Dhakale	40	M	71	Kapha vata	Manda	Madhyam	Hemant
80	Urmila Pawar	48	F	70	Kapha pitta	Manda	Madhyam	Sharad
81	Suresh Patil	26	M	65	Kapha pitta	Manda	Madhyam	Hemant
82	Sitaram Nikam	43	M	58	Vata Pitta	Tikshna	Mrudu	Hemant
83	Shivam Jundre	20	M	54	Vata Pitta	Visham	Krura	Hemant
84	Kantabai Kunjir	45	F	56	Kapha pitta	Tikshna	Madhyam	Hemant
85	Shrikant Mishra	45	M	64	Vata Pitta	Manda	Madhyam	Hemant
86	Bhagyashree Chipkar	32	F	62	Pitta kapha	Visham	Madhyam	Hemant
87	Hafsa Surme	40	F	51	Vata Pitta	Visham	Krura	Hemant
88	Balasaheb Solaskar	50	M	52	Vata kapha	Visham	Madhyam	Hemant
89	Bhavarlal Jain	48	M	63	Kapha pitta	Manda	Madhyam	Hemant
90	Mohamad Sharif	45	M	61	Pitta kapha	Tikshna	Mrudu	Hemant
91	Maruti Pimpale	41	M	60	Kapha pitta	Manda	Madhyam	Hemant
92	Damodar Sarwade	48	M	62	Kapha vata	Manda	Madhyam	Hemant
93	Subhash Nikam	46	M	48	Vata Pitta	Visham	Krura	Hemant
94	Ahsan Ali	45	M	60	Kapha pitta	Tikshna	Mrudu	Hemant

95	Ravindra Gharat	26	M	64	Kapha vata	Visham	Krura	Hemant
96	Firoz Ahmad Khan	48	M	48	Vata kapha	Visham	Krura	Hemant
97	Pooja Yadav	25	F	58	Vata Pitta	Tikshna	Madhyam	Hemant
98	Harak Singh	46	M	64	Pitta kapha	Tikshna	Mrudu	Hemant
99	Sanket Pawar	36	M	71	Kapha vata	Manda	Madhyam	Hemant
100	Suchita Patil	42	F	67	Kapha pitta	Manda	Madhyam	Hemant
101	Pooja Yeole	28	F	47	Vata Pitta	Visham	Krura	Hemant
102	Divya Kadu	40	F	61	Pitta kapha	Tikshna	Mrudu	Hemant
103	Ankita Gupta	35	F	58	Vata Pitta	Visham	Madhyam	Hemant
104	Sampada Gharat	27	F	65	Kapha pitta	Visham	Madhyam	Hemant
105	Sadhana Nansar	50	F	62	Vata Pitta	Tikshna	Madhyam	Hemant
106	Varsha Bhatija	49	F	58	Pitta kapha	Tikshna	Mrudu	Hemant
107	Neela Khedkar	48	F	61	Vata Pitta	Visham	Madhyam	Hemant
108	Asma Lambe	32	F	57	Vata Pitta	Visham	Krura	Hemant
109	Akabai Sonawane	50	F	65	Pitta kapha	Tikshna	Mrudu	Hemant

Season of exacerbation	Bowel habits relation with spasm	Desha	Bala	Poorvaroop (T 6)	Roop (T 13)
Shishir/Hemant	No	Sadharan	Madhyam	3	4
Hemnat/varsha	Yes	Sadharan	Madhyam	3	5
no specific	Yes	Sadharan	Madhyam	2	5
Hemant/Shishir	No	Sadharan	Madhyam	3	5
no specific	No	Sadharan	Madhyam	3	5
Shishir/greeshma	No	Sadharan	Madhyam	3	4
Greeshma/varsha	No	Sadharan	Madhyam	4	6
Varsha/sharad	Yes	Sadharan	Madhyam	2	4
Varsha/sharad	Yes	Sadharan	Madhyam	3	4
Varsha/sharad	Yes	Sadharan	Madhyam	3	4
Sharad/vasant	No	Sadharan	Madhyam	2	5
Varsha/sharad	No	Anoop	Madhyam	4	5
Varsha/sharad	No	Sadharan	Madhyam	3	4
Varsha/hemant	No	Sadharan	Uttam	4	6
Varsha/sharad	No	Sadharan	Madhyam	4	7
Varsha/vasant	No	Sadharan	Madhyam	4	5
Varsha/sharad	Yes	Sadharan	Uttam	3	7
Greeshma/varsha	No	Sadharan	Uttam	3	6
Varsha/shishir	No	Sadharan	Madhyam	3	4
Varsha/shishir	No	Sadharan	Madhyam	3	5
Varsha	No	Sadharan	Madhyam	3	5
Varsha/sharad	Yes	Sadharan	Madhyam	3	5
Varsha/sharad	No	Sadharan	Uttam	4	5
Hemant/Varsha	Yes	Sadharan	Madhyam	3	3
Sharad	No	Sadharan	Uttam	3	4
Varsha/shishir	No	Anoop	Madhyam	3	5
Varsha /sharad	Yes	Sadharan	Madhyam	3	6
Sharad	No	Sadharan	Madhyam	3	4
Sharad/varsha/shishir	No	Sadharan	Madhyam	2	6
Varsha/sharad	No	Sadharan	Madhyam	3	5
Varsha/vasant	No	Sadharan	Madhyam	3	6
Varsha/shishir	No	Sadharan	Madhyam	3	4
with incr heat	No	Sadharan	Madhyam	3	4
Varsha	Yes	Sadharan	Madhyam	4	5
Varsha/sharad	No	Sadharan	Uttam	3	6
Shishir	Yes	Sadharan	Madhyam	2	4
Varsha/vasant	No	Anoop	Madhyam	3	4
Sharad/varsha/vasant	No	Sadharan	Madhyam	3	5
Sharad/varsha	Yes	Sadharan	Madhyam	3	5
Sharad/vasant	No	Sadharan	Madhyam	2	6
Sharad/greeshma	No	Sadharan	Madhyam	4	5
Varsha	No	Sadharan	Madhyam	3	6
Sharad/greeshma	Yes	Sadharan	Madhyam	3	3
Sharad/greeshma	Yes	Sadharan	Madhyam	3	6

Sharad/greeshma	Yes	Sadharan	Madhyam	4	4
Sharad/vasant	No	Sadharan	Madhyam	3	4
Sharad	No	Sadharan	Madhyam	3	4
Sharad/greeshma	Yes	Anoop	Madhyam	4	6
Sharad/greeshma	Yes	Sadharan	Alpa	4	7
Sharad/vasant	No	Sadharan	Alpa	5	5
Sharad/varsha	Yes	Sadharan	Madhyam	3	6
Sharad/greeshma	Yes	Sadharan	Alpa	4	4
Sharad/varsha	Yes	Sadharan	Madhyam	3	7
Sharad/hemant	No	Sadharan	Uttam	2	5
Sharad/varsha/greeshma	Yes	Sadharan	Madhyam	4	6
Sharad/vasant	Yes	Sadharan	Madhyam	4	7
Sharad/vasant/greeshma	No	Sadharan	Alpa	4	6
Sharad/greeshma	No	Sadharan	Madhyam	4	7
Sharad/varsha	No	Sadharan	Madhyam	3	6
sharad	No	Sadharan	Madhyam	3	4
vasant/sharad	No	Sadharan	Madhyam	3	3
Sharad	No	Sadharan	Madhyam	3	5
Sharad/greeshma	No	Sadharan	Madhyam	3	6
Sharad/greeshma	No	Sadharan	Madhyam	3	4
Sharad/greeshma	No	Sadharan	Madhyam	4	4
Sharad/greeshma	No	Sadharan	Uttam	4	6
Sharad/greeshma	No	Sadharan	Madhyam	3	6
Sharad/greeshma	No	Sadharan	Madhyam	3	5
no specific	No	Sadharan	Madhyam	4	7
Hemant/shishir/varsha	No	Sadharan	Madhyam	5	7
no specific	No	Sadharan	Madhyam	4	6
Sharad/vasant	No	Sadharan	Madhyam	3	5
Sharad/greeshma	No	Sadharan	Madhyam	4	6
Sharad/greeshma	Yes	Sadharan	Madhyam	5	7
Sharad/varsha	Yes	Sadharan	Madhyam	5	8
Hemant/shishir	Yes	Sadharan	Madhyam	4	6
Hemant/varsha	Yes	Anoop	Madhyam	4	7
Hemant/shishir	No	Sadharan	Madhyam	4	6
Hemant/varsha	Yes	Sadharan	Madhyam	4	7
Hemant/varsha	Yes	Sadharan	Madhyam	4	6
Hemant/shishir	No	Sadharan	Madhyam	4	8
Hemant/shishir	No	Sadharan	Madhyam	4	6
Hemant/shishir	Yes	Sadharan	Alpa	4	6
Hemant/varsha	Yes	Sadharan	Madhyam	4	7
Hemant/shishir	No	Sadharan	Alpa	4	7
Hemnat/varsha	No	Sadharan	Madhyam	4	8
Hemant/varsha	Yes	Sadharan	Alpa	5	5
Varsha /hemant/shishir	Yes	Sadharan	Alpa	4	7
Varsha/hemant	Yes	Sadharan	Madhyam	5	6
Hemant/shishir	No	Sadharan	Madhyam	4	7
Hemant/shishir/varsha	No	Sadharan	Alpa	5	6
Hemant/shishir	Yes	Sadharan	Madhyam	3	6
Hemant/varsha	Yes	Sadharan	Alpa	4	7
Hemant/shishir/varsha	No	Sadharan	Madhyam	5	6

Hemant/shishir	Yes	Sadharan	Madhyam	5	8
Hemant/shishir	Yes	Sadharan	Alpa	4	6
Hemant/shishir	No	Sadharan	Madhyam	5	7
Hemant/shishir	No	Sadharan	Madhyam	4	8
Hemant/shishir/varsha	Yes	Sadharan	Alpa	4	5
Hemant/shishir	No	Sadharan	Madhyam	4	6
Hemant/shishir	Yes	Sadharan	Alpa	4	8
Hemant/shishir	No	Sadharan	Madhyam	5	6
Hemant/shishir	Yes	Sadharan	Madhyam	5	6
Hemant/varsha	No	Sadharan	Madhyam	5	6
Hemant/shishir	No	Sadharan	Madhyam	3	6
Hemant/shishir	No	Sadharan	Madhyam	4	6
Hemant/shishir	Yes	Sadharan	Madhyam	4	5
Hemant/varsha	Yes	Sadharan	Madhyam	4	5
Hemant/shishir	No	Sadharan	Madhyam	4	5

GI symptoms wd exacerbation 6	Vata prakopak hetusevan 16	Pitta prakopak hetusevan 14	Kapha prakopak hetusevan 12	Sushrut Hetu 13	Heridity	Smoking
5	2	4	1	4	No	No
4	2	5	1	4	No	No
3	5	3	1	3	No	No
3	2	3	1	2	No	Yes
5	3	6	2	4	No	Yes
5	4	5	1	2	No	Yes
4	5	7	3	1	No	No
6	3	6	2	3	No	Yes
5	2	4	2	2	No	No
4	4	1	1	2	Yes	No
4	3	3	0	2	No	Yes
3	4	6	2	0	No	No
4	3	6	1	2	No	No
4	5	7	2	3	No	No
5	5	5	1	3	No	Yes
3	3	4	1	3	No	No
4	3	3	1	1	Yes	Yes
5	5	4	1	1	No	Yes
4	3	4	2	3	Yes	No
5	1	2	2	3	No	No
5	4	5	2	4	No	No
4	3	4	1	3	No	Yes
5	6	5	1	1	No	Yes
4	2	4	1	3	No	No
5	6	8	1	3	No	No
3	1	5	2	3	No	No
4	3	3	3	5	No	Yes
5	3	7	2	3	Yes	Yes
4	1	6	3	3	Yes	No
5	2	5	1	4	No	No
5	1	3	2	4	Yes	No
6	1	5	2	5	No	No
5	4	9	1	3	No	Yes
5	2	2	1	5	Yes	Yes
4	4	8	0	2	No	Yes
4	3	2	2	6	No	No
6	2	4	1	3	No	Yes
6	1	5	3	4	Yes	Yes
5	3	3	1	5	Yes	No
5	2	4	0	5	No	No
5	2	7	1	2	Yes	No
3	4	7	1	0	No	No
4	2	2	1	3	No	No
6	2	2	1	5	No	Yes

5	5	5	1	3	No	Yes
4	3	3	0	3	No	Yes
6	2	8	1	2	No	Yes
6	3	9	1	4	No	Yes
6	3	4	2	5	No	Yes
5	2	3	1	2	No	No
4	1	6	1	4	No	Yes
5	1	7	1	5	No	No
5	3	6	1	1	No	Yes
4	2	2	1	4	Yes	No
4	3	7	1	0	No	No
6	3	3	3	2	Yes	No
5	2	5	0	2	Yes	No
5	7	5	1	2	Yes	No
5	2	7	1	3	No	Yes
4	3	6	1	2	No	No
4	2	5	0	5	No	No
4	3	6	0	3	No	No
7	7	8	1	5	No	No
4	2	5	1	3	Yes	No
5	7	6	2	2	No	No
4	3	6	0	3	No	No
5	4	6	1	2	Yes	No
4	2	5	1	2	No	Yes
5	3	4	1	1	No	Yes
6	4	5	4	3	No	No
4	2	8	1	3	Yes	No
4	3	6	0	2	No	Yes
5	3	4	3	2	No	Yes
4	2	4	2	2	No	Yes
4	4	7	1	2	No	Yes
5	6	7	4	1	No	Yes
4	4	5	2	2	Yes	Yes
5	1	4	3	1	No	No
5	3	6	1	3	No	No
5	5	8	1	2	No	No
4	3	7	1	2	No	No
4	7	5	1	3	No	Yes
5	5	5	3	2	No	Yes
5	5	8	1	2	No	Yes
4	4	3	3	3	No	No
5	3	5	2	3	No	No
5	3	6	2	4	No	No
5	4	5	2	4	No	Yes
5	5	5	2	2	No	No
4	4	5	3	2	No	No
5	6	5	1	2	No	No
5	3	6	2	2	No	No
5	6	5	2	0	No	Yes
5	7	6	2	2	No	No

5	6	5	2	2	No	Yes
5	3	7	4	2	Yes	Yes
4	3	6	3	2	Yes	No
5	3	7	2	1	No	Yes
6	3	5	3	1	No	Yes
5	4	5	2	1	No	No
6	5	4	2	1	Yes	No
5	4	6	3	1	No	No
5	6	5	3	1	No	No
5	4	6	1	2	No	No
5	6	7	2	1	No	No
4	5	7	3	2	No	No
6	1	6	2	4	No	No
3	3	4	3	2	No	No
4	1	5	1	2	No	No

stress	Occupational reason	Specific allergy	H/O Parasites	Pranavaha srotodushti 7	Annavaha srotodushti
Yes	No	cold water/food	No	2	2
Yes	No	No	No	2	3
Yes	No	Pungent smell	No	2	2
Yes	Yes	Cement smell	No	2	2
Yes	No	spicy food	No	3	2
Yes	No	Smoke	Yes	4	3
No	No	No	No	4	3
Yes	Yes	Chemical smell	No	3	2
Yes	No	No	No	2	3
Yes	No	cold water/food	No	4	2
Yes	No	Dust smoke	No	3	2
Yes	No	Hot spicy nveg food	No	3	3
Yes	No	Spicy oily food	No	2	3
Yes	No	No	No	4	3
No	No	No	No	4	3
Yes	No	Spicy sour fried food	No	3	2
Yes	No	No	Yes	4	2
No	No	No	No	4	2
Yes	No	Spicy sour fried food	No	2	2
Yes	No	Cold spicy dry food	No	3	2
Yes	No	Milk product banana	No	2	3
Yes	No	No	No	4	2
Yes	No	No	No	3	3
No	No	seafood pungent smell	No	2	2
No	No	Spicy food banana	No	3	3
Yes	No	seafood	No	3	3
Yes	Yes	Smell of paint	No	4	2
Yes	No	No	No	3	2
Yes	No	Milk dahi seafood	Yes	3	3
Yes	Yes	Paint Chemicals	No	3	3
Yes	No	Milk products	No	3	3
No	No	No	No	4	3
Yes	No	Spicy pungent food	No	3	3
Yes	No	No	No	4	3
No	No	No	No	4	3
No	No	No	No	3	2
Yes	No	Dust wind	No	4	3
Yes	No	Dahi fish	No	2	3
Yes	Yes	Chemical smell	No	4	3
Yes	No	Peanut chana vatana	No	2	3
No	No	No	No	3	3
Yes	No	No	No	3	2
Yes	No	No	No	3	2
No	No	No	No	4	3

Yes	No	No	No	3	3
Yes	Yes	Chemical smell	No	3	3
Yes	Yes	Hot spicy food	No	3	2
Yes	No	Peanut	No	3	3
Yes	No	No	Yes	3	3
Yes	Yes	Milk chana	Yes	4	2
Yes	No	No	Yes	4	3
Yes	No	Yes	Yes	3	3
Yes	No	No	Yes	3	2
No	No	Cold beverage	No	3	1
Yes	No	No	Yes	4	3
Yes	No	No	Yes	3	3
Yes	No	No	Yes	4	3
No	No	No	Yes	4	3
Yes	No	No	No	4	3
No	No	Dust smoke	No	3	2
Yes	No	Sour cold food	No	3	1
Yes	No	Spicy food	Yes	4	3
No	No	Dust pungent smell	No	3	2
No	No	Smoke dust	No	3	2
No	No	No	Yes	4	3
No	No	No	No	4	3
Yes	No	No	Yes	3	3
Yes	No	No	No	3	2
Yes	Yes	Chemical smell	No	4	3
Yes	No	No	Yes	4	3
Yes	No	No	Yes	4	3
Yes	No	No	No	3	3
Yes	No	No	No	3	3
Yes	No	No	Yes	4	3
Yes	No	No	Yes	3	3
Yes	No	Dahi	Yes	3	3
Yes	No	No	Yes	3	3
Yes	No	No	Yes	4	3
Yes	No	Sour food mirachi	Yes	4	3
Yes	No	No	Yes	4	3
Yes	No	Sea food	No	4	3
Yes	No	No	Yes	4	3
Yes	No	Seafood	Yes	3	3
Yes	No	No	Yes	3	3
Yes	No	Cold food	Yes	4	3
Yes	No	Smell	No	4	3
No	No	Milk chana	Yes	4	3
Yes	No	Dust smoke	No	4	3
Yes	No	Dust smoke	Yes	4	3
No	No	Dust smoke	No	4	3
No	No	Smoke smell	Yes	4	3
Yes	No	No	No	4	3
Yes	No	Smoke	Yes	4	3
No	No	No	No	4	3

Yes	No	No	No	4	3
Yes	No	No	No	4	3
Yes	No	No	No	4	3
Yes	No	No	Yes	3	3
Yes	Yes	Smell of paint	No	4	3
No	No	No	Yes	4	3
Yes	No	No	No	4	3
Yes	No	No	No	4	3
Yes	No	No	Yes	4	3
No	No	No	No	4	3
No	No	No	No	3	3
No	No	No	No	4	3
No	No	No	No	4	3
No	No	No	No	4	3
No	No	No	No	4	3

Serotonin in Avegavastha	Serotonin in Vegavastha

Sr No	Name	Age	Sex	WT	Prakriti	Agni	Koshtha	Season of Assessment
1	R B	45	F	54	Kapha vata	Manda	Madhyam	Shishir
2	Sf	28	F	55	Kapha	Manda	Krura	Shishir
3	G B	37	M	65	Vata Pitta	Manda	Madhyam	Shishir
4	A k	35	M	55	Vata	Manda	Mrudu	Shishir
5	D M	49	M	40	Vata	Manda	Madhyam	Shishir
6	G M	25	M	52	Pitta kapha	Tikshna	Mrudu	Shishir
7	P W	43	F	60	Kapha pitta	Manda	Madhyam	Greeshma
8	D P	32	M	54	Pitta kapha	Manda	Madhyam	Varsha
9	A T	35	M	61	Pitta vata	Manda	Madhyam	Varsha
10	A C	40	M	58	Vata Pitta	Tikshna	Madhyam	Varsha
11	K S	32	M	62	Pitta vata	Tikshna	Madhyam	Varsha
12	K K	42	F	59	Pitta kapha	Tikshna	Mrudu	Varsha
13	S P	26	M	54	Vata kapha	Visham	Madhyam	Varsha
14	U G	50	F	60	Kapha pitta	Manda	Madhyam	Varsha
15	Sk	45	M	58	Kapha pitta	Manda	Madhyam	Varsha
16	S G	36	F	68	Kapha pitta	Manda	Mrudu	Varsha
17	V P	50	M	61	Kapha pitta	Manda	Madhyam	Varsha
18	Gg	26	M	48	Vata Pitta	Tikshna	Madhyam	Varsha
19	S G	48	M	65	Vata Pitta	Tikshna	Madhyam	Varsha
20	S H	47	M	69	Kapha vata	Sama	Madhyam	Varsha
21	R M	50	F	60	Pitta vata	Sama	Mrudu	Varsha
22	S A	42	M	58	Vata Pitta	Visham	Madhyam	Varsha
23	B K	48	M	60	Pitta kapha	Tikshna	Mrudu	Varsha
24	K	40	F	45	Pitta kapha	Visham	Krura	Varsha
25	N K	24	F	50	Vata Pitta	Sama	Mrudu	Sharad
26	J S	43	M	71	Kapha pitta	Manda	Madhyam	Varsha
27	B L	41	M	52	Vata Pitta	Visham	Madhyam	Sharad
28	A R	35	M	56	Pitta kapha	Manda	Mrudu	Varsha
29	R S	39	M	70	Kapha pitta	Sama	Madhyam	Sharad
30	S S	44	F	65	Pitta kapha	Tikshna	Mrudu	Shishir
31	P S	46	F	68	Kapha pitta	Manda	Madhyam	Varsha
32	U P	40	F	70	Kapha pitta	Manda	Madhyam	Varsha
33	M D	50	M	60	Kapha pitta	Manda	Madhyam	Sharad
34	M P	31	M	48	Vata Pitta	Visham	Krura	Varsha
35	S C	30	M	58	Kapha pitta	Manda	Madhyam	Varsha
36	M R	50	F	68	Kapha pitta	Visham	Madhyam	Varsha
37	S J	47	M	62	Vata Pitta	Tikshna	Mrudu	Varsha
38	Sd	43	M	72	Pitta kapha	Tikshna	Madhyam	Varsha
39	P A	47	F	65	Vata Pitta	Visham	Krura	Sharad
40	P A	39	F	57	Kapha pitta	Manda	Mrudu	Sharad
41	S G	31	M	57	Pitta kapha	Tikshna	Mrudu	Sharad
42	P G	28	F	54	Pitta vata	Manda	Mrudu	Varsha
43	S S	50	F	60	Kapha pitta	Manda	Krura	Sharad
44	S D	50	M	48	Vata Pitta	Manda	Krura	Sharad
45	U C	37	M	60	Pitta kapha	Visham	Madhyam	Sharad

46	K A	42	M	69	Kapha pitta	Tikshna	Mrudu	Sharad
47	P W	45	M	50	Pitta kapha	Manda	Madhyam	Varsha
48	A S	43	M	48	Vata Pitta	Manda	Madhyam	Sharad
49	S H	45	M	54	Vata kapha	Visham	Madhyam	Sharad
50	V V	38	M	60	Kapha vata	Visham	Madhyam	Sharad
51	P J	47	M	69	Kapha pitta	Manda	Madhyam	Sharad
52	A C	45	M	55	Vata Pitta	Tikshna	Madhyam	Sharad
53	R P	36	M	60	Kapha vata	Manda	Madhyam	Sharad
54	R S	36	M	58	Kapha pitta	Manda	Madhyam	Varsha
55	A S	42	F	62	Kapha vata	Manda	Madhyam	Sharad
56	Md	41	M	62	Kapha pitta	Visham	Madhyam	Sharad
57	V P	42	M	54	Pitta vata	Tikshna	Mrudu	Sharad
58	S T	50	F	68	Pitta kapha	Visham	Madhyam	Sharad
59	Y U	49	M	68	Kapha pitta	Manda	Madhyam	Sharad
60	A S	26	F	48	Pitta kapha	Sama	Madhyam	Sharad
61	S T	39	F	52	Pitta kapha	Sama	Mrudu	Hemant
62	S T	50	F	52	Pitta vata	Tikshna	Mrudu	Sharad
63	R P	35	F	45	Pitta Vata	Sama	Mrudu	Sharad
64	S B	30	F	50	Pitta kapha	Sama	Mrudu	Sharad
65	Ng	38	F	62	Kapha pitta	Manda	Madhyam	Sharad
66	V S	46	M	56	Pitta vata	Tikshna	Mrudu	Sharad
67	M M	29	F	60	Pitta kapha	Visham	Madhyam	Sharad
68	V K	40	M	60	Kapha pitta	Tikshna	Mrudu	Sharad
69	S T	45	M	68	Kapha pitta	Manda	Madhyam	Sharad
70	V P	28	F	67	Pitta kapha	Tikshna	Mrudu	Sharad
71	L D	50	F	70	Kapha pitta	Tikshna	Mrudu	Sharad
72	A S	47	M	66	Kapha pitta	Tikshna	Madhyam	Sharad
73	Shk	42	M	65	Pitta kapha	Visham	Madhyam	Sharad
74	D P	43	M	65	Kapha pitta	Manda	Madhyam	Sharad
75	P W	44	M	55	Vata Pitta	Tikshna	Krura	Sharad
76	S T	46	M	70	Pitta kapha	Visham	Krura	Sharad
77	K R	22	M	57	Kapha vata	Manda	Madhyam	Sharad
78	S P	25	F	70	Kapha pitta	Manda	Madhyam	Sharad
79	M D	40	M	71	Kapha vata	Manda	Madhyam	Hemant
80	U P	48	F	70	Kapha pitta	Manda	Madhyam	Sharad
81	S P	26	M	65	Kapha pitta	Manda	Madhyam	Hemant
82	S N	43	M	58	Vata Pitta	Tikshna	Mrudu	Hemant
83	S J	20	M	54	Vata Pitta	Visham	Krura	Hemant
84	K K	45	F	56	Kapha pitta	Tikshna	Madhyam	Hemant
85	S M	45	M	64	Vata Pitta	Manda	Madhyam	Hemant
86	B C	32	F	62	Pitta kapha	Visham	Madhyam	Hemant
87	H S	40	F	51	Vata Pitta	Visham	Krura	Hemant
88	B S	50	M	52	Vata kapha	Visham	Madhyam	Hemant
89	B J	48	M	63	Kapha pitta	Manda	Madhyam	Hemant
90	M S	45	M	61	Pitta kapha	Tikshna	Mrudu	Hemant
91	M P	41	M	60	Kapha pitta	Manda	Madhyam	Hemant
92	D S	48	M	62	Kapha vata	Manda	Madhyam	Hemant
93	S N	46	M	48	Vata Pitta	Visham	Krura	Hemant
94	A A	45	M	60	Kapha pitta	Tikshna	Mrudu	Hemant
95	R G	26	M	64	Kapha vata	Visham	Krura	Hemant

96	F A	48	M	48	Vata kapha	Visham	Krura	Hemant
97	P Y	25	F	58	Vata Pitta	Tikshna	Madhyam	Hemant
98	H S	46	M	64	Pitta kapha	Tikshna	Mrudu	Hemant
99	S P	36	M	71	Kapha vata	Manda	Madhyam	Hemant
100	S P	42	F	67	Kapha pitta	Manda	Madhyam	Hemant
101	P Y	28	F	47	Vata Pitta	Visham	Krura	Hemant
102	D K	40	F	61	Pitta kapha	Tikshna	Mrudu	Hemant
103	A G	35	F	58	Vata Pitta	Visham	Madhyam	Hemant
104	S G	27	F	65	Kapha pitta	Visham	Madhyam	Hemant
105	S N	50	F	62	Vata Pitta	Tikshna	Madhyam	Hemant
106	V B	49	F	58	Pitta kapha	Tikshna	Mrudu	Hemant
107	N K	48	F	61	Vata Pitta	Visham	Madhyam	Hemant
108	A L	32	F	57	Vata Pitta	Visham	Krura	Hemant
109	A S	50	F	65	Pitta kapha	Tikshna	Mrudu	Hemant

Season of exacerbation	Bowel habits relation with spasm	Desha	Bala	Poorvaroop (T 6)	Roop (T 13)	GI symptoms wd exacerbation 6
Shishir/Hemant		Sadharan	Madhyam	3	4	5
Hemnat/varsha		Sadharan	Madhyam	3	5	4
no specific	Yes	Sadharan	Madhyam	2	5	3
Hemant/Shishir		Sadharan	Madhyam	3	5	3
no specific	No	Sadharan	Madhyam	3	5	5
Shishir/greeshma	No	Sadharan	Madhyam	3	4	5
Greeshma/varsha	No	Sadharan	Madhyam	4	6	4
Varsha/sharad	Yes	Sadharan	Madhyam	2	4	6
Varsha/sharad	Yes	Sadharan	Madhyam	3	4	5
Varsha/sharad	Yes	Sadharan	Madhyam	3	4	4
Sharad/vasant	No	Sadharan	Madhyam	2	5	4
Varsha/sharad	No	Anoop	Madhyam	4	5	3
Varsha/sharad	No	Sadharan	Madhyam	3	4	4
Varsha/hemant	No	Sadharan	Uttam	4	6	4
Varsha/sharad	No	Sadharan	Madhyam	4	7	5
Varsha/vasant	No	Sadharan	Madhyam	4	5	3
Varsha/sharad	Yes	Sadharan	Uttam	3	7	4
Greeshma/varsha	No	Sadharan	Uttam	3	6	5
Varsha/shishir	No	Sadharan	Madhyam	3	4	4
Varsha/shishir	No	Sadharan	Madhyam	3	5	5
Varsha	No	Sadharan	Madhyam	3	5	5
Varsha/sharad	Yes	Sadharan	Madhyam	3	5	4
Varsha/sharad	No	Sadharan	Uttam	4	5	5
Hemant/Varsha	Yes	Sadharan	Madhyam	3	3	4
Sharad	No	Sadharan	Uttam	3	4	5
Varsha/shishir	No	Anoop	Madhyam	3	5	3
Varsha /sharad	Yes	Sadharan	Madhyam	3	6	4
Sharad	No	Sadharan	Madhyam	3	4	5
Sharad/varsha/shishir	No	Sadharan	Madhyam	2	6	4
Varsha/sharad	No	Sadharan	Madhyam	3	5	5
Varsha/vasant	No	Sadharan	Madhyam	3	6	5
Varsha/shishir	No	Sadharan	Madhyam	3	4	6
with incr heat	No	Sadharan	Madhyam	3	4	5
Varsha	Yes	Sadharan	Madhyam	4	5	5
Varsha/sharad	No	Sadharan	Uttam	3	6	4
Shishir	Yes	Sadharan	Madhyam	2	4	4
Varsha/vasant	No	Anoop	Madhyam	3	4	6
Sharad/varsha/vasant	No	Sadharan	Madhyam	3	5	6
Sharad/varsha	Yes	Sadharan	Madhyam	3	5	5
Sharad/vasant	No	Sadharan	Madhyam	2	6	5
Sharad/greeshma	No	Sadharan	Madhyam	4	5	5
Varsha	No	Sadharan	Madhyam	3	6	3
Sharad/greeshma	Yes	Sadharan	Madhyam	3	3	4
Sharad/greeshma	Yes	Sadharan	Madhyam	3	6	6
Sharad/greeshma	Yes	Sadharan	Madhyam	4	4	5

Sharad/vasant	No	Sadharan	Madhyam	3	4	4
Sharad	No	Sadharan	Madhyam	3	4	6
Sharad/greeshma	Yes	Anoop	Madhyam	4	6	6
Sharad/greeshma	Yes	Sadharan	Alpa	4	7	6
Sharad/vasant	No	Sadharan	Alpa	5	5	5
Sharad/varsha	Yes	Sadharan	Madhyam	3	6	4
Sharad/greeshma	Yes	Sadharan	Alpa	4	4	5
Sharad/varsha	Yes	Sadharan	Madhyam	3	7	5
Sharad/hemant	No	Sadharan	Uttam	2	5	4
Sharad/varsha/greeshma	Yes	Sadharan	Madhyam	4	6	4
Sharad/vasant	Yes	Sadharan	Madhyam	4	7	6
Sharad/vasant/greeshma	No	Sadharan	Alpa	4	6	5
Sharad/greeshma	No	Sadharan	Madhyam	4	7	5
Sharad/varsha	No	Sadharan	Madhyam	3	6	5
sharad	No	Sadharan	Madhyam	3	4	4
vasant/sharad	No	Sadharan	Madhyam	3	3	4
Sharad	No	Sadharan	Madhyam	3	5	4
Sharad/greeshma	No	Sadharan	Madhyam	3	6	7
Sharad/greeshma	No	Sadharan	Madhyam	3	4	4
Sharad/greeshma	No	Sadharan	Madhyam	4	4	5
Sharad/greeshma	No	Sadharan	Uttam	4	6	4
Sharad/greeshma	No	Sadharan	Madhyam	3	6	5
Sharad/greeshma	No	Sadharan	Madhyam	3	5	4
no specific	No	Sadharan	Madhyam	4	7	5
Hemant/shishir/varsha	No	Sadharan	Madhyam	5	7	6
no specific	No	Sadharan	Madhyam	4	6	4
Sharad/vasant	No	Sadharan	Madhyam	3	5	4
Sharad/greeshma	No	Sadharan	Madhyam	4	6	5
Sharad/greeshma	Yes	Sadharan	Madhyam	5	7	4
Sharad/varsha	Yes	Sadharan	Madhyam	5	8	4
Hemant/shishir	Yes	Sadharan	Madhyam	4	6	5
Hemant/varsha	Yes	Anoop	Madhyam	4	7	4
Hemant/shishir	No	Sadharan	Madhyam	4	6	5
Hemant/varsha	Yes	Sadharan	Madhyam	4	7	5
Hemant/varsha	Yes	Sadharan	Madhyam	4	6	5
Hemant/shishir	No	Sadharan	Madhyam	4	8	4
Hemant/shishir	No	Sadharan	Madhyam	4	6	4
Hemant/shishir	Yes	Sadharan	Alpa	4	6	5
Hemant/varsha	Yes	Sadharan	Madhyam	4	7	5
Hemant/shishir	No	Sadharan	Alpa	4	7	4
Hemnat/varsha	No	Sadharan	Madhyam	4	8	5
Hemant/varsha	Yes	Sadharan	Alpa	5	5	5
Varsha /hemant/shishir	Yes	Sadharan	Alpa	4	7	5
Varsha/hemant	Yes	Sadharan	Madhyam	5	6	5
Hemant/shishir	No	Sadharan	Madhyam	4	7	4
Hemant/shishir/varsha	No	Sadharan	Alpa	5	6	5
Hemant/shishir	Yes	Sadharan	Madhyam	3	6	5
Hemant/varsha	Yes	Sadharan	Alpa	4	7	5
Hemant/shishir/varsha	No	Sadharan	Madhyam	5	6	5
Hemant/shishir	Yes	Sadharan	Madhyam	5	8	5

Hemant/shishir	Yes	Sadharan	Alpa	4	6	5
Hemant/shishir	No	Sadharan	Madhyam	5	7	4
Hemant/shishir	No	Sadharan	Madhyam	4	8	5
Hemant/shishir/varsha	Yes	Sadharan	Alpa	4	5	6
Hemant/shishir	No	Sadharan	Madhyam	4	6	5
Hemant/shishir	Yes	Sadharan	Alpa	4	8	6
Hemant/shishir	No	Sadharan	Madhyam	5	6	5
Hemant/shishir	Yes	Sadharan	Madhyam	5	6	5
Hemant/varsha	No	Sadharan	Madhyam	5	6	5
Hemant/shishir	No	Sadharan	Madhyam	3	6	5
Hemant/shishir	No	Sadharan	Madhyam	4	6	4
Hemant/shishir	Yes	Sadharan	Madhyam	4	5	6
Hemant/varsha	Yes	Sadharan	Madhyam	4	5	3
Hemant/shishir	No	Sadharan	Madhyam	4	5	4

Vata prakopak hetusevan 16	Pitta prakopak hetusevan 14	Kapha prakopak hetusevan 12	Sushrut Hetu 13	Heridity	Smoking	stress	Occupational reason
2	4	1	4	No	No	Yes	No
2	5	1	4	No	No	Yes	No
5	3	1	3	No	No	Yes	No
2	3	1	2	No	Yes	Yes	Yes
3	6	2	4	No	Yes	Yes	No
4	5	1	2	No	Yes	Yes	No
5	7	3	1	No	No	No	No
3	6	2	3	No	Yes	Yes	Yes
2	4	2	2	No	No	Yes	No
4	1	1	2	Yes	No	Yes	No
3	3	0	2	No	Yes	Yes	No
4	6	2	0	No	No	Yes	No
3	6	1	2	No	No	Yes	No
5	7	2	3	No	No	Yes	No
5	5	1	3	No	Yes	No	No
3	4	1	3	No	No	Yes	No
3	3	1	1	Yes	Yes	Yes	No
5	4	1	1	No	Yes	No	No
3	4	2	3	Yes	No	Yes	No
1	2	2	3	No	No	Yes	No
4	5	2	4	No	No	Yes	No
3	4	1	3	No	Yes	Yes	No
6	5	1	1	No	Yes	Yes	No
2	4	1	3	No	No	No	No
6	8	1	3	No	No	No	No
1	5	2	3	No	No	Yes	No
3	3	3	5	No	Yes	Yes	Yes
3	7	2	3	Yes	Yes	Yes	No
1	6	3	3	Yes	No	Yes	No
2	5	1	4	No	No	Yes	Yes
1	3	2	4	Yes	No	Yes	No
1	5	2	5	No	No	No	No
4	9	1	3	No	Yes	Yes	No
2	2	1	5	Yes	Yes	Yes	No
4	8	0	2	No	Yes	No	No
3	2	2	6	No	No	No	No
2	4	1	3	No	Yes	Yes	No
1	5	3	4	Yes	Yes	Yes	No
3	3	1	5	Yes	No	Yes	Yes
2	4	0	5	No	No	Yes	No
2	7	1	2	Yes	No	No	No
4	7	1	0	No	No	Yes	No
2	2	1	3	No	No	Yes	No
2	2	1	5	No	Yes	No	No
5	5	1	3	No	Yes	Yes	No

3	3	0	3	No	Yes	Yes	Yes
2	8	1	2	No	Yes	Yes	Yes
3	9	1	4	No	Yes	Yes	No
3	4	2	5	No	Yes	Yes	No
2	3	1	2	No	No	Yes	Yes
1	6	1	4	No	Yes	Yes	No
1	7	1	5	No	No	Yes	No
3	6	1	1	No	Yes	Yes	No
2	2	1	4	Yes	No	No	No
3	7	1	0	No	No	Yes	No
3	3	3	2	Yes	No	Yes	No
2	5	0	2	Yes	No	Yes	No
7	5	1	2	Yes	No	No	No
2	7	1	3	No	Yes	Yes	No
3	6	1	2	No	No	No	No
2	5	0	5	No	No	Yes	No
3	6	0	3	No	No	Yes	No
7	8	1	5	No	No	No	No
2	5	1	3	Yes	No	No	No
7	6	2	2	No	No	No	No
3	6	0	3	No	No	No	No
4	6	1	2	Yes	No	Yes	No
2	5	1	2	No	Yes	Yes	No
3	4	1	1	No	Yes	Yes	Yes
4	5	4	3	No	No	Yes	No
2	8	1	3	Yes	No	Yes	No
3	6	0	2	No	Yes	Yes	No
3	4	3	2	No	Yes	Yes	No
2	4	2	2	No	Yes	Yes	No
4	7	1	2	No	Yes	Yes	No
6	7	4	1	No	Yes	Yes	No
4	5	2	2	Yes	Yes	Yes	No
1	4	3	1	No	No	Yes	No
3	6	1	3	No	No	Yes	No
5	8	1	2	No	No	Yes	No
3	7	1	2	No	No	Yes	No
7	5	1	3	No	Yes	Yes	No
5	5	3	2	No	Yes	Yes	No
5	8	1	2	No	Yes	Yes	No
4	3	3	3	No	No	Yes	No
3	5	2	3	No	No	Yes	No
3	6	2	4	No	No	No	No
4	5	2	4	No	Yes	Yes	No
5	5	2	2	No	No	Yes	No
4	5	3	2	No	No	No	No
6	5	1	2	No	No	No	No
3	6	2	2	No	No	Yes	No
6	5	2	0	No	Yes	Yes	No
7	6	2	2	No	No	No	No
6	5	2	2	No	Yes	Yes	No

3	7	4	2	Yes	Yes	Yes	No
3	6	3	2	Yes	No	Yes	No
3	7	2	1	No	Yes	Yes	No
3	5	3	1	No	Yes	Yes	Yes
4	5	2	1	No	No	No	No
5	4	2	1	Yes	No	Yes	No
4	6	3	1	No	No	Yes	No
6	5	3	1	No	No	Yes	No
4	6	1	2	No	No	No	No
6	7	2	1	No	No	No	No
5	7	3	2	No	No	No	No
1	6	2	4	No	No	No	No
3	4	3	2	No	No	No	No
1	5	1	2	No	No	No	No

Specific allergy	H/O Parasites	Pranavaha srotodushti 7	Annavaha srotodushti 4	Serotonin in Avegavastha	Serotonin in Vegavastha
cold water/food	No	2	2	183.3	533.9
No	No	2	3	178.5	305.8
Pungent smell	No	2	2	157.3	186.8
Cement smell	No	2	2	125.2	286.5
spicy food	No	3	2	234.3	232.6
Smoke	Yes	4	3	174.8	157.7
No	No	4	3	339.1	241.4
Chemical smell	No	3	2	391.3	158.3
No	No	2	3	284.5	513.6
cold water/food	No	4	2	201.1	191.3
Dust smoke	No	3	2	341.1	481
Hot spicy nveg food	No	3	3	118.8	121.7
Spicy oily food	No	2	3	145.9	145.9
No	No	4	3	110.6	613.5
No	No	4	3	214.9	214.9
Spicy sour fried food	No	3	2	154.2	172.1
No	Yes	4	2	170.5	360.4
No	No	4	2	109.1	280.9
Spicy sour fried food	No	2	2	137.1	351.5
Cold spicy dry food	No	3	2	166.7	170
Milk product banana	No	2	3	216.7	819.8
No	No	4	2	176.4	494.2
No	No	3	3	230.5	490.2
seafood pungent smell	No	2	2	187.2	350.2
Spicy food banana	No	3	3	340.5	160.5
seafood	No	3	3	177.9	275.5
Smell of paint	No	4	2	280.9	190.2
No	No	3	2	154.2	245.6
Milk dahi seafood	Yes	3	3	337.9	146.7
Paint Chemicals	No	3	3	124.9	310.8
Milk products	No	3	3	200.1	188.4
No	No	4	3	172.8	220.1
Spicy pungent food	No	3	3	119.8	119.1
No	No	4	3	214.2	348.9
No	No	4	3	140.9	186.3
No	No	3	2	112.9	475.4
Dust wind	No	4	3	150.2	474.8
Dahi fish	No	2	3	230.9	290.3
Chemical smell	No	4	3	107.1	165.7
Peanut chana vatana	No	2	3	171.5	525.7
No	No	3	3	385.2	170
No	No	3	2	176.9	510.5
No	No	3	2	135.1	498.6
No	No	4	3	165.2	615.3
No	No	3	3	179.2	181.1

Chemical smell	No	3	3	178.4	291.8
Hot spicy food	No	3	2	158.3	524.2
Peanut	No	3	3	120.2	154.2
No	Yes	3	3	235.8	825
Milk chana	Yes	4	2	178.1	225.5
No	Yes	4	3	339.1	160.8
Yes	Yes	3	3	175.7	300.1
No	Yes	3	2	325.6	622
Cold beverage	No	3	1	119.8	240.6
No	Yes	4	3	150.1	190.3
No	Yes	3	3	112.4	508.3
No	Yes	4	3	154.8	212.2
No	Yes	4	3	390.5	363.4
No	No	4	3	171.5	278.6
Dust smoke	No	3	2	215.2	486.1
Sour cold food	No	3	1	110.1	118.4
Spicy food	Yes	4	3	211.5	355.1
Dust pungent smell	No	3	2	136.1	150.9
Smoke dust	No	3	2	214.1	170.2
No	Yes	4	3	160.9	468.5
No	No	4	3	174.2	170
No	Yes	3	3	181.3	190.2
No	No	3	2	175.4	150.6
Chemical smell	No	4	3	158.3	832.4
No	Yes	4	3	214.5	161.8
No	Yes	4	3	230.8	640.8
No	No	3	3	126.2	310.7
No	No	3	3	290.3	180.9
No	Yes	4	3	342.8	479.1
No	Yes	3	3	224.8	124.6
Dahi	Yes	3	3	175.8	375.1
No	Yes	3	3	218.9	182.7
No	Yes	4	3	119.8	651.2
Sour food mirachi	Yes	4	3	345.6	175.4
No	Yes	4	3	147.9	346.3
Sea food	No	4	3	111.9	545.4
No	Yes	4	3	395.5	571.3
Seafood	Yes	3	3	153.2	164.5
No	Yes	3	3	171.5	383.1
Cold food	Yes	4	3	216.4	192.2
Smell	No	4	3	109.1	355.6
Milk chana	Yes	4	3	135.1	820.4
Dust smoke	No	4	3	168.9	514.8
Dust smoke	Yes	4	3		
Dust smoke	No	4	3		
Smoke smell	Yes	4	3		
No	No	4	3		
Smoke	Yes	4	3		
No	No	4	3		
No	No	4	3		

No	No	4	3
No	No	4	3
No	Yes	3	3
Smell of paint	No	4	3
No	Yes	4	3
No	No	4	3
No	No	4	3
No	Yes	4	3
No	No	4	3
No	No	3	3
No	No	4	3
No	No	4	3
No	No	4	3
No	No	4	3