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Critical comparison of *Yogic Nadi* with Nervous System

Sachin G. Khedikar, Mukund P. Erande, Deepnarayan V. Shukla



Abstract- The term "*Nadi*" is derived from *Nad Dhatu* in Sanskrit which means to flow something inside a structure. These are said to be 3.50.000 in the human body, of these the principal ones are ten. Among these *Ida*, *Pingala* and *Sushumna* are the chief. Though *Sushumna* is hidden, along with *Ida* and *Pingala* these three *Nadis* meet at *Triveni* point which lies at the site of *Adnya Chakra* behind the centre of two eyebrows.

The extensive description of these *Nadis* is established in *Yogic compendia* but their functional and spiritual aspects are well enlightened there. In order to identify structures related to these *Nadis* this study was initiated through literature search from *Yogic compendia* as well as texts of contemporary science. The *Nadis* are comparable with nervous system of our body. It is seen that *Ida*, *Pingala* and *Sushumna* shows structural similarities between left, right sympathetic trunk and Spinal cord respectively.

Key Words- *Ida*, *Pingala*, *Sushumna*, *Nadi*, Nervous system

Introduction:

Nadis or vessels or nerves are the structures which provide pathways to flow of energy. The *Sushumna* alone is highest and beloved of the *Yogis* & other vessels are subordinate to it in the body. All the principal *Nadis* are directed downwards and supported by the vertebral column and represent the Sun, Moon and Fire. [1]The innermost of these is *Chitra nadi* where the subtlest of all hollows called *Bramha-randhra* is present and is a Heavenly way as per *Shashtra*. This is the giver of the joy of immortality; by contemplating on it a great *Yogi* destroys all his sins.

Shad-chakra and *Nadis* described in *Yoga Samhitas* has given more emphasis on its physiological and spiritual aspects. So it is an attempt to intricate structural aspects and correlation of these *Nadis* with body organs.

Materials & Methods:

The texts of *Yoga*, *Samhitas* related to *Yoga* and *Swasthavritta* textbooks were mainly referred for this study. Supportive texts of contemporary science and journals were also utilized to comprehend the ancient concepts. Since *Tantra Sharir* is briefly described in textbooks of *Rachana Sharir*, mostly on functional and spiritual aspects, so to highlight structural part and correlation of *Ida*, *Pingala* & *Sushumna Nadis* with anatomical structures in the body, this study was initiated.

Observations and Results:

"*Nadi*" is a structure through which something flows inside it. [2] It is a medium for flow of *Pranic* energy (vital power). The practice of *Pranayama*, set right the flow of *Pranic* energy which is impaired by our defective diet and life style. [3] [4] Amongst *Nadis* transporting vital power *Ida*, *Pingala* and *Sushumna* are foremost. These *Nadis* acts in collaboration

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Corresponding Author:

Sachin G. Khedikar, Associate Professor, Dept. of Rachana-Sharir, Mahatma Gandhi Ayurved College, Hospital & Research Centre, Wardha - 442004

Email: sach21009@gmail.com

Co-author (s):

Mukund P. Erande, Professor & H.O.D., Dept. of Rachana Sharir, Sumatibhai Shah Ayurved College, Malwadi, Hadapsar, Pune-411028
Deepnarayan V. Shukla, Professor & H.O.D., Dept. of Rachana Sharir, R. A. Podar Medical College (Ayu.), Worli, Mumbai-400018

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with *Shadchakra* & perform essential physical, mental and autonomous functions. [5] A relational hypothesis can be staged here, that the flow of axoplasm and also the endoplasm within the axon and cell body of a neuron must be considered while interpreting the meaning of the term "Nadi".

Nadi is like a stalk of Lotus those are directed inferiorly and lies in the vicinity of vertebral column. [6] In Ayurveda it refers to Artery which is stated in *Nadi-pariksha* while in *Yoga* it is quoted in context of Nervous system. In *Trishikh-bramhanopnishada* the appearance of these *Nadis* is described as soft like filaments of Lotus and fills similar to electric current when touched. Among these *Sushumna* is situated in vertebral column in median plane.

Sushumna is situated in between two *Kanda* (hemisphere) like a stalk of Lotus which is directed upwards to connect with *Bramha-vivara* (foramen magnum). When impulses pass through it to *Bramha-randhra*, it gives feeling of transitory electric current. *Ida* is named as *Chandranadi* and *Pingala* is also called as *Suryanadi* are situated on lateral aspect of *Sushumna* out of which *Ida* lies on left side of *Kanda* and traced at left nostril whereas *Pingala* is located at right side *Kanda* [7,8].

Though *Sushumna* is hidden, along with *Ida* and *Pingala* these three *Nadis* meet at *Triveni* point which lies at the site of *Adnya Chakra* behind the centre of two eyebrows. [9] Normally both *Ida* and *Pingala* acts alternately. *Ida* and *Pingala* are connected to *Mooladhar chakra* and runs upwards surrounding *Sushumna* by all directions to join with *Adnya Chakra*. Then these *Nadis* get separated to

establish association with left and right nostrils. *Sushumna Nadi* originates from *Mooladhar* and is continuous up to *Bramha-randhra* which is situated at root (base) of skull. Usually *Sushumna* is stable and *Kundalini* which appears like snake is located at *Mooladhar Chakra*. When *Sushumna* is activated, the functions of *Ida* and *Pingala* are impaired. As soon as *Prana* ascend through activated *Sushumna* the *Ida* and *Pingala* becomes inactive and the respiration through both nostrils is initiated. Activated *Kundalini* when reaches to *Sahastrar Chakra*, it results in association of *Jiva* with *Bramha* which is foremost goal of *Yoga*. [10]

As per *Darshano-panishada* all *Nadis* are scattered around the *Sushumna*. While according to *Prashno-panishada* 72,000 *Nadis* are originated from *Nabhi* (umbilicus) through its *Moolkanda* (main centre) and spread all over the body. Out of 24 major *Nadis* total 10 *Nadis* are important and carry *Prana* in the body.

1) *Ida Nadi*: Inspiration through it always gives cool effects in body even if the environment is hot.

2) *Pingala Nadi*: Sun factor (heat) is streamed through this *Nadi* and maintains the body temperature.

3) *Sushumna Nadi*: *Ida* and *Pingala* surround *Sushumna* in such a way that they twist upon it which results in the formation of *Shadchakra* [11].

Work to be followed in timings of *Svara/Nadi* : After reviewing the above table and literature related to *Ida* and *Pingala* *Nadis* it can be inferred that the *Ida Svara* can be correlated with parasympathetic dominance and *Pingala Svara* with sympathetic dominance of ANS [12,13].

Table 1: *Trividha Nadi* - Indication of work to be followed and other details

<i>Ida Nadi</i>	<i>Pingala Nadi</i>	<i>Sushumna Nadi</i>
All auspicious & easy work	Hard & difficult activities	Activities related to God
Chandra-Nadi, Ganga	Surya-Nadi, Yamuna	Mahapath, Sarsvati
Left Side of Kanda & Sushumna	Right Side of Kanda & Sushumna	Sushumna is hidden
Traced at left nostril	Traced at right nostril	Situated bet ⁿ <i>Ida</i> & <i>Pingala</i> ,
Act alternately	Act alternately	Chief among major 10 <i>Nadis</i> .
Runs upwards surrounding Sushumna to join with Adnya Chakra	Runs upwards surrounding Sushumna to join with Adnya Chakra	Meet with <i>Ida</i> & <i>Pingala</i> at <i>Triveni</i> point which lies at the site of <i>Adnya Chakra</i> .
Get separated to establish association with left nostril	Get separated to establish association with right nostril	Originates from <i>Mooladhar</i> & continue to <i>Bramharandhra</i>
It helps in maintaining the cold and anabolic activity of the body	Sun factor (heat) is streamed through this <i>Nadi</i> and maintains the body temperature.(Catabolic)	Usually stable - if activated, the functions of <i>Ida</i> and <i>Pingala</i> are impaired
		Respiration through both nostrils is initiated upon activation

The functioning of both cerebral hemispheres is different, when the energy flow occurs in the left hemisphere, things like logical thinking, calculations, function related to vocabulary, grammar and technical ideas come out easily. On the other hand when the energy flow occurs in the right hemisphere, things like acting, music and poetry come easily and emotions, faith and belief become prominent. [14]

Discussion:

The word *Nadi* is derived from *Nad Dhatu* in Sanskrit which means to flow something inside a structure. It is a tubular structure which comes in different contexts like *Dhamani*, *Vanshee*, *Bhagandara* and Vessels etc in Ayurvedic literature [15]. As *Sira*, *Dhamani* and *Strotas* are independently described by Sushruta in *Sharir-sthana*, the *Nadis* described in *Yoga-shashtra* are different from these. As per present knowledge of modern anatomy, the tube like or cord like structures present in the body and appears in close relation to vessels can be interpreted as NERVE as per Yogic thinking philosophy. So the *Nadis* described in *Tantra Sharir* may be compared with nerves in the body.

In *Trishikh-bramhanopnishada* the paradigm of lotus not only indicates the consistency but also the color of *Nadi*, because the color of lotus filament is similar to color of nerve. As it is known any compression on nerve by external or internal structure produces tingling sensation in the nerve as well as in surrounding tissue. So the feeling of electric current and tingling may understood as same. So the description of *Nadis* enlightened in *Yoga-samhitas* is similar to nerves as per modern science. Mechanism of genesis of Action potential phenomenon must be studied thoroughly by interested scholars to interpret this hypothesis precisely.

If the literature related to *Sushumna* is studied well, then following points are striking:

- It is hidden like river *Sarsvati* & its synonyms are *Bramharandhra*, *Mahapath* & *Yogavallabha*.
- Situated between two *Kanda* (hemispheres) & appear like stalk of lotus (with flower)
- It originates from *Mooladhara* and is directed upwards to connect with *Bramha-vivar* (*Randhra*).

-*Ida* and *Pingala* are situated on lateral aspect of *Sushumna* out of which *Ida* lies on left side of *Kanda* and traced at left nostril whereas *Pingala* is placed on right side.

The spinal cord is not only the lower part of CNS but also a centre for reflex activities. It occupies the upper two thirds of vertebral canal and extends from the level of the upper border of the atlas to the lower border of vertebra L₁ or the upper border of L₂. It is connected to cerebrum and cerebellum through brainstem which consists of medulla oblongata, the pons and the midbrain. [16]

Above stated references from *Yogic* and contemporary sciences if compared, then it can be said that *Sushumna Nadi* affirmed in *Yoga* has great similarities with spinal cord because it is a greatest part of nervous system which is hidden or protected in vertebral column. If upper expanded part of CNS is considered like lotus flower then spinal cord will appear like its stalk.

It is quoted in *Yoga* texts that “When *Ida* and *Pingala* are equally flowing then these *Nadis* end in *Sushumna* and during this stage *Kundalini shakti* is way in here.” For understanding this we can consider 'Respiration process' which is an ANS activity. In *Pranayam* there is voluntary manipulation of ANS functions and after long practice of *Pranayam*, there is possibility of getting some voluntary control over ANS which will ultimately reduce the activity of ANS and thereby increase the activity of CNS i.e. Spinal cord. Bhargava R, Gogate MG et al. had inferred that *Pranayama* breathing exercises appear to alter autonomic responses to breathe holding probably by increasing vagal tone and decreasing sympathetic discharge.[15] So the execution of *Nadi* or *Swara* in *Yogic* compendia can be interpreted in terms of ANS activity. Imperative details of *Ida* and *Pingala Nadi* can be enumerated as as depicted in table 2.

The structural components of these *Nadis* can be understood with the help of contemporary science. It is said that *Ida* & *Pingala* surround *Sushumna* in curved or bend direction. The course of nerve fibres in the sympathetic innervations of upper limb would be an

Table 2: Comparison of *Ida* and *Pingla Nadi*

<i>Ida Nadi</i>	<i>Pingala Nadi</i>
<i>Chandra-Nadi</i> , <i>Ganga</i> , Left Side of <i>Sushumna</i> & Traced at left nostril	<i>Surya-Nadi</i> , <i>Yamuna</i> , Right side of <i>Sushumna</i> & Traced at right nostril
<i>Ida</i> & <i>Pingala</i> both runs upwards surrounding <i>Sushumna</i> to join with <i>Adnya Chakra</i>	

an example for understanding this bend path.

Sympathetic Innervations of Upper Limbs:

Sympathetic nerves for upper limb are derived from spinal segments T₂ - T₆. The pre-ganglionic fibers arise from lateral horn cells & emerge from the spinal cord through ventral nerve roots. Passing through white rami communicans they reach the sympathetic chain. They ascend within the chain and end in the middle cervical, inferior cervical & first thoracic ganglia. The post-ganglionic fibers from respective ganglia pass through grey rami communicans and reach the respective nerve roots.

Spinal cord provides primary path and accommodation for autonomous nervous system but its entire course and secondary path is afforded by ganglia and sympathetic chain. By union of all sympathetic chains a single structure is formed which is recognized as sympathetic trunk. The uppermost ganglion in the trunk is a superior cervical ganglion which extends from the transverse process of the atlas to the tip of the greater cornua of the hyoid bone. [16] The spinal cord is also commences from this level. This fact is important because in *Yoga Samhitas* *Ida*, *Pingala* and *Sushumna* end at *Triveni* point which lies at the site of *Adnya Chakra* behind the centre of two eyebrows.

Physiological sketch of *Ida* and *Pingala Nadis* shows similarity with ANS. The lateralization of the body is described in *Yoga Samhita*. There are few structural differences are also identified in branching of Sympathetic chain. Abdominal Part of the A.N.S. could be an example where the preganglionic vagal fibres for coeliac plexus are derived from the posterior vagal trunk containing fibers from both the right and left vagal nerves. The fibers from the right vagus predominate. Similarly in Parasympathetic division fibers from the pelvic splanchnic nerves reach superior hypogastric plexus through the inferior hypogastric plexus. Usually the fibers ascend through the left part of the superior hypogastric plexus. [17]

In *Yoga Samhitas* it is said that *Ida* and *Pingala* surrounds *Sushumna* in such way that they wind upon it, resulting in the formation of *Mooladhar*, *Swadhisthan*, *Manipoor*, *Anahat* and *Vishuddha Chakras* and these *Nadis* acts in collaboration with *Shadchakra*. This can be understood by studying the course of ANS where ganglia of sympathetic chain give some lateral as well as medial branches. In case of lumbar sympathetic chain Lateral branches are distributed to all five

lumbar nerves through grey rami communicans while Medial lumbar splanchnic nerves are generally four in number. The upper two join the coeliac and aortic plexus and the lower two join the superior hypogastric plexus. So the formation of *Shadchakra* can be realized by this example. *Ida Nadi* is said to be placed on left side of *Sushumna*, if overall literature of ANS is studied well then it can be said that maximum part of it, is contributed by left sympathetic trunk.

The inferior territory of sympathetic trunk if premeditated for learning origin of *Trividha Nadis* then it is seen that sympathetic trunk lies along the medial margin of the pelvic foramina of sacrum. The truth that *Ida* and *Pingala* lie on lateral position of *Sushumna*, can be understood here because terminal part of spinal cord i.e. filum terminale is situated between two sympathetic trunks. Again the most important feature of this part is Ganglion Impar which lies over the coccyx. This looks like '*Kundalini*' whose appearance is mentioned as snake like in *Yoga samhita*.

Ida and *Pingala* form association with left and right nostrils respectively which is known as *Svara* in *Yogic* texts. Uppermost part of Sympathetic Trunk can throw light on this concept. The Superior cervical ganglion (SCG) is located opposite C₂ & C₃. It lies deep to the sheath of the internal carotid artery. The SCG supply sympathetic innervations to a number of target organs within the head. Carotid body is one of major sympathetic innervations of SCG. The post ganglionic axons of the SCG innervate internal carotid artery & form internal carotid plexus. The ICP carries the postganglionic axons of the SCG to the eye, lacrimal gland, mucous membranes of the nose mouth and pharynx. [18]

One study provides evidence of sympathomimetic effects of right nostril initiated *Pranayama* with sympatholytic/ parasympathomimetic effect following left nostril initiated *Pranayama*. The main effect of UNB and ANB techniques is determined by the nostril used for inspiration rather than that used for expiration. The right and left yogic UNB and ANB techniques have differential physiological effects that are in tune with the traditional *Svara* yoga concept that air flow through right nostril (SN and *Pingala swara*) is activatory in nature whereas the flow through left nostril (CN and *Ida swara*) is relaxatory. [19]

Chandra Nadi Pranayam i.e. left unilateral forced nasal breathing is effective in reducing Heart rate and systolic blood pressure in hypertensive

patients on regular standard medical management. This may be due to a normalization of autonomic cardiovascular rhythms with increased vagal modulation and/or decreased sympathetic activity along with improvement in baroreflex sensitivity. [20]

The sympathetic component of ANS in abdominal part is Vasomotor, motor to sphincters, inhibitors to peristalsis & sensory to viscera supplied. The *Suryanadi pranayam* i.e. right unilateral forced breathing along with some Asana were intervened in diarrhea-predominant irritable bowel syndrome subjects. Two months of both conventional with loperamide and yogic intervention showed a significant decrease of bowel symptoms and state anxiety. This was accompanied by an increase in electrophysiologically recorded gastric activity in the conventional intervention group and enhanced parasympathetic reactivity, as measured by heart rate parameters, in yogic intervention group. [21] This study indicates sympathomimetic activity of *Suryanadi* or *Pingala Nadi*.

After a discussion on various parts of ANS with *Ida* and *Pingala Nadi*, the structural correlation of these *Nadis* can be done with the help of figure from Tortora G J, Vol - 1, p 550 (Fig.1)

Fig.1: Structural correlation of *Ida, Pingla Nadi* with nervous system

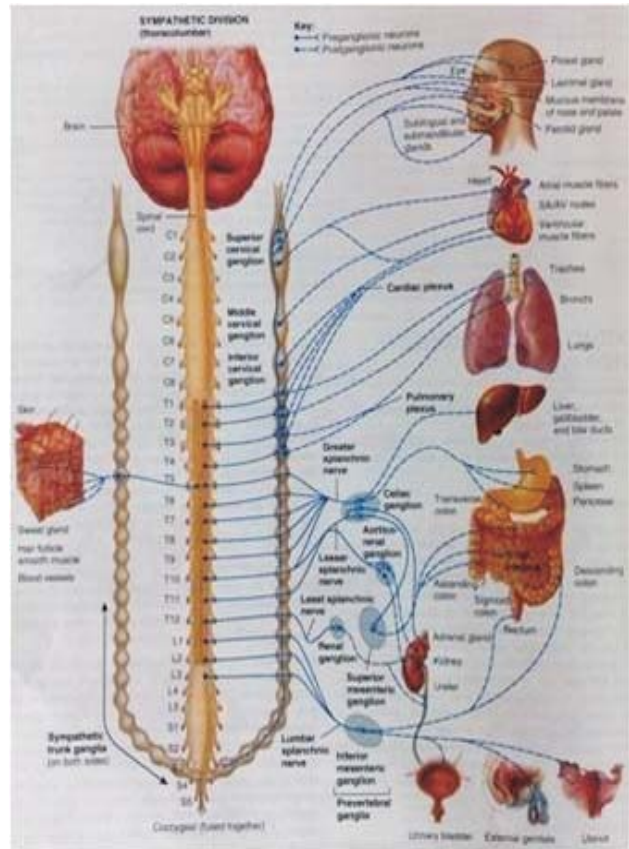


Table 3: Correlation between *Chakra* and plexus along with their effect on meditation

SN	Name of Chakra	Place	Plexus	Effects on Meditation (balance & healthy)
1	<i>Muladhar</i>	Between the root of reproductory organ and anus	Pelvic Plexus (sacro-coccygeal plexus)	Courage, strong will, confident, humanistic, spontaneous and honesty
2	<i>Swadhishtana</i>	The origin of the reproductory organ	Hypogastic	Sociable, independent, constructive, energetic and enthusiastic
3	<i>Manipura</i>	Navel of Nabhi Sthana	Coeliac or Solar	Confidence, humorous, practical, intellectual, Alert and Optimistic
4	<i>Anahata</i>	Heart (chest)	Cardiac	Compassionate, generous, romantic, self controlled, adaptable, sympathetic and loving
5	<i>Vishuddha</i>	At the base of the throat of Kantha-Mula Sthana	Caratid & pharyngeal	Loyal, trustworthy, affectionate, caring, tactful and calm
6	Adnya	At the space between the two eyebrows or Bhru-Madhya	Cavernous	Orderly, clear sighted, faithful, fearless, practical, idealistic and highly intuitive

As noted in table showing features of *Ida & Pingala Nadi* these are situated on left & right side of *Sushumna* respectively. These runs upwards surrounding *Sushumna* to join with *Adnya Chakra*. If this narration is compared and tried to understand the related structures to these *Nadis* then we can say that.

Sushumna can be correlated with spinal cord, *Ida* with left sympathetic trunk and *Pingala* with right sympathetic trunk. Though structural component are similar in the trunks, the two cerebral hemispheres show different functions upon their activation. So the activation in respective cerebral hemisphere may alter the functioning of relevant sympathetic trunk resulting in *Yogic* classification like *Ida & Pingala Nadi*.

Conclusion:

Nadis affirmed in *Yoga Samhitas* can be correlated with Nervous system of the body. Functionally, *Ida Nadi* can be correlated with parasympathetic whereas *Pingala Nadi* with sympathetic activities of the body. The activation of *Ida Nadi* by Pranayama and Aasana shows parasympathomimetic while *Pingala Nadi* shows sympathomimetic effects on ANS. This outline of *Ida* and *Pingala Nadi* can be utilized to maintain the sympathovagal balance of important systems of body like CVS and GIT.

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