



Review Article

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INTERPRETATION OF SNAYU IN CLASSICAL TEXTS BASED ON INFERENTIAL ANATOMICAL EXPLORATIONS: A REVIEW

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ABSTRACT

Contemporary validation is the need of the hour when it comes to Ayurveda. Discrepancy in theories of Ayurveda and contemporary science makes this validation quite challenging. The anatomical terms mentioned in the classical texts need to be deciphered appropriately as the impact of these ideas are not just limited to a structure but to its physiological, surgical, pathological and surgical aspects. The term Snayu has always been a controversial structure when it comes to an anatomical validation. The objective of this review article is to correlate Snayu and its types to structures in the human body on the basis of cadaveric dissection through observation and inference. The methodology involved is a thorough literary review on structure and location of Snayu and its comparison to the anatomical structure in the background of dissection techniques and observation methods used in the ancient texts. It was observed that Snayu can be correlated to fibrous structures of human body like fascia, ligaments, tendons, aponeurosis etc.

Keywords: Prathanavati, Prithula, Kandara, Sushirasnayu, Snayujalam, Ligament, Tendon, Retinaculum, Aponeurosis.

INTRODUCTION

In Ayurvedic classics, anatomical description of Shareera is a subject which needs a lot of research. The details of Shareera mentioned in our Samhitas are derived by acharyas with the help of pramanas like Pratyaksha, Anumana and Upamana. Their inferences and discoveries have been mentioned in very concise form or sutras. To have a very clear concept of these theories, we have to try to understand and decipher the sutras. Sushruta Samhita is of paramount importance when it comes to surgical or anatomical aspects in Ayurveda. The importance of Pratyaksha Jnana through Mrita Shareera shodhana is well explained in the text¹. Understanding the methodology of Mrita Shareera Samshodhan - the ancient technique of preserving and dissecting a cadaver is relevant to this study. In the ancient methodology, the selected cadaver is wrapped in plants like Kusha, Shana etc and immersed in water for 7 days². Later the cadaver is taken out and is examined from the superficial to the deeper structures using a brush like instrument the Kurcha. Unlike the modern method of dissecting the cadaver in layers, acharyas perceived the structure of the human body as a whole. Inculcating this view of human body will help us in finding the missing links regarding anatomical terms mentioned in the texts. There is still a great lacuna in interpreting anatomical terms referred to in the classics. One of such term is Snayu. The importance in exact understanding of this structure is better understood if we observe plethora of references of Snayu throughout the Ayurvedic texts, which spans over structural, physiological, pathological, as well as treatment modalities. Owing to the extent of implication, a lot of ambiguity is present in relation to this term. This review article is an attempt to clarify the anatomic correlation of Snayu, its classification and variants with the help of cadaveric dissection. As we read through our classics, Snayu has been explained as mostly probably resembling a fibrous structure.

Conception and design

Etymological and historical data related to Snayu from available Sanskrit Dictionaries, Vedas, Upanishads, Puranas, Niruktas and epics. Ayurvedic literary review from Brihatrayiies and Laghutrayi and other important texts were searched for relevant data. Modern literary data of fibrous structures of human body from comprehensive anatomy and physiology texts, journals, scientific papers and internet were collected. Detailed information regarding materials resembling Snayu was collected from various books, journals and internet. Observation of dissected cadaver was done for correlating facts.

Literary Review

According to Sushruta Samhita, Snayu is a structure which binds joints and enables the body to bear weight³. Sharangadhara Samhita also quotes on Snayu as a structure which binds the body by binding mamsa, Asthi and medas⁴. Like the proper binding of wood enables a ship to bear weight, the Snayu also helps in binding the bones and joints strongly enabling the proper locomotor functioning of the body³.

Snayu-Simile in Texts

In Sushruta Samhita, Acharya Dalhana has explained snayu as shankara which is used to tie a bow⁵. Similar references are available in Dhanurveda where an elaborate description of preparation of bow is given⁶. It is mentioned in this context that Snayu is the first material of choice to tie a bow. This can be of deer, she-buffalo, or a cow. It is also mentioned that if Snayu is unavailable from Jangama dravyas, Snayu from Sthavara dravyas can also be utilized for the same purpose. The materials which are mentioned for this purpose are vamsatwacha and arkatwacha. Here an attempt is made to have a detailed study on these Sthavara dravyas which are said to resemble Snayu or serves the same

purpose of Snayu. This attempt is done to give further insight into the physical properties of Snayu.

Shana

Shana is a synonym for the plant shanapushpi with the botanical name *Crotalaria juncea* which is usually known as Sunnhemp⁷. Sunnhemp (*Crotalaria aria juncea*, L), belongs to the sub-order Papilionaceae of order Leguminosae. It is an annual shrub cultivated for its fine fiber and legume⁸.

Uses of Sunnhemp fibers

Sunnhemp is grown primarily for cordage used for rope, string and fishing nets which is considerably stronger than that of jute⁸. It is also resistant to saltwater. The tow from retted fiber is used for marine caulking. Strength is one of the most important properties which largely determine the quality of a fiber and is calculated as tenacity, a ratio of breaking load of fiber (in g), to the fineness (in tex). The filaments of Sunnhemp have the following physical properties: Tenacity of filament (g / tex) 30-40, Tenacity of bundle (g/tex) 15-35, Extension at break (%) 2.5-3.5

Murva

Murva is a controversial drug. Amongst the many names of this plant one is dhanurgunpayoga meaning the plant whose bark is being used for the bow-strings⁹. Other synonyms are triparni, piluparni etc. Among all the herbs considered as Murva in various places, *Marsdenia tenacissima* of Asclepiadaceae family, also known as Rajmahal creeper, is generally found apt. This creeper exactly resembles the true Murva because it has milky juice or latex, its fibers are very strong and roots are used as laxative and are usually sold as white Trivrit.

Uses of *Marsdenia tenacissima* fibers

The fibre obtained from the stem of this plant is said to be the second best in India and one of the strongest plant origin fibre in the world but still not utilized commercially¹⁰. The bark of young shoots also yields a strong fibre. The fibre from *Marsdenia* is used for making ropes, cords and strings. The fibre has been found to contain little or no lignocellulose, and to be exceptionally resistant to the action of alkalis. It can be kept for long periods in water with little harm.

Vamsa

Vamsa is one of the herbs mentioned in all ancient scriptures of Ayurveda. It has various synonyms like yavaphala, sataparva, karmuka, sabdamala, suparva, dhanusya, dhridaparva, kicaka etc¹¹.

Physical Properties of Bamboo Fiber

Bamboo fiber is an excellent biodegradable, elastic environment friendly green fiber with strength equivalent to conventional glass fibers¹². In addition, the fiber is bacteriostatic, antifungal, antibacterial, hypoallergenic, hydroscopic, natural deodorizer and resistant against ultraviolet light. Furthermore, it is highly durable, stable and tough and has substantial tensile strength with a dry tensile strength (cN/dtex) - 2.33 and dry elongation at breakage (cN/dtex) - 1.37.

Arka

Arka is a medicinal plant mentioned in all ancient scripts of Ayurveda. Two or more types of arka have been mentioned in different Ayurvedic texts¹³. The two varieties of arka usually mentioned are, one with white flowers (*Calotropis procera*) and the other with lilac, rosy or purple tinted flowers (*Calotropis gigantea*). The white flowered variety, Alarka is said to be of superior quality, though all the commentators are of the opinion that either of these can be used with equal effect, as both have the same properties.

Uses of *Calotropis*

The plant yields a durable fiber commercially known as bowstrings which is also used for making ropes, carpets, fishing nets and sewing thread¹⁴.

Classification of Snayu

A total of 900 Snayu's have been explained in the classical texts¹⁵. Detailed description of types of Snayu is only available in Sushruta Samhita¹⁶. The Snayu has been classified into 4. They are Prathanavati, vritha, prithu, and sushira¹³. Prathanavati Snayu's are found in all Shakhas and Sandhis. Experts consider Vritta Snayu as kandara. Sushirasnayu is found at the distal ends of amashaya, pakwashaya and Vasthi. Prithu Snayu's are found in Parshwa, Uras, Prishtha, and Siras.

Interpretation and inference

Detailed observation of simile of Snayu reveals that these are sources for fibrous structures which are strong enough to withstand a certain amount of tension. An overall observation of these structures gives an impression that Snayu is nothing else but a fibrous structure visible in the body. The fibrous structures like fascia, ligaments, tendons, Aponeurosis etc may be correlated to Snayu.

Prathanavati Snayu

The word Prathanavati means which spreads like creepers. This type of Snayu is found in Shakha (limbs) and Asthi Sandhi (joints). The tendons of the extremities exactly resemble the creepers. In the distal part the tendons divide and spread out into the digits (flexor and extensor tendons of limbs) in the same way as the terminal branches of a creeper does. Observation of the joints with the related ligaments around shows that these ligaments have a tangled appearance, crossing one over the other as the branches of creepers appear. It is similar to the way a creeper would cover an object in its path through all sides embedding within it the object firmly.

Prithula Snayu

Prithu means vast and thin. In this context it is relevant to assume that this type of Snayu spreads or covers a large area. This type of Snayu is present in Parshwa, Uras, Prishtha and Siras. The fibrous structures observed which are flat and covers a large area are the aponeurosis. Similar to the explanation of sites explained in the classics these can be seen in the Parshwa (flanks) – Aponeurosis of the anterior abdominal wall muscles, Uras (chest) – Aponeurosis of the anterior abdominal wall muscles extends till the 5th rib which is the chest region, Prishtha (back) – the muscles trapezius and latissimus dorsi originates as flat fibrous structure covering the whole back, siras (head) – the skull is covered by scalp, one of the layers of which is aponeurosis which lies beneath the skin and covers the whole scalp.

Vritha Snayu

Vritha means round. This is also called as kandara. Special sites for these are not mentioned. It has to be assumed that these are present all over the body. Some of the muscle tendons of the body are felt as round structures between our fingers like Achilles tendon.

Shodasha Kandara

Acharya Sushruta has explained 16 Kandas in detail in the chapter Sarira Sankhya vyakarana in Sarira Sthana¹⁷. This chapter starts with the description of Anga pratyangas, moving on to the avayavas which are related to the pratyangas. The Shodasha Kandas are mentioned in this context. Here the first question which arises is why these 16 Kandas have been told before the description of Snayu where again kandara is said to be a synonym of vritha Snayu. The separate description of Shodasha Kandara surely points at a different view which the Acharya had on this, other than as one among the 4 types of Snayu. In the context of explaining Shodasha Kandara, Dalhana has mentioned these as Maha Snayu or those Snayu's which big or prominent ones in the human body are. Here it should be considered that the prominent 16 Maha Snayu has been explained which may or may not be Vritta Snayu. These Kandas are said to be present in relation to four regions which are hasta, pada, greeva, and Prishta having 4 Kandas each. While we go in depth in to the details of Shodasha Kandas, it is clear that these may also have extent in to the nearby or related regions too. The extent of these Kandas has been described as Adhobhagagata (moving downwards) and Uparibhagagata (moving upwards) both of which have separate Agrimaparoha (end).

Hastagata Kandara – These are 4 in number, 2 in each hasta. From the explanation given regarding the extent of these, it can be deciphered as below to nails or bones of Anguli and above to Bahusira or Amsapinda region as well as sthana region. Further description of Hastagata Kandas is available in Sushruta Samhita Nidana sthana while explaining Vishwachinidana. In the Urdhva Shakha, among the 2 Kandas 1 is Uparibhagagata towards the tala of hasta and the other is Adhobhagagata (Bahu Prishta) towards the anguli¹⁸.

Padagata Kandara – These are 4 in number, 2 in each pada. The extent is below in the nails or bones of Anguli and above in the uru region. Further description of Padagata Kandas is available in Sushruta Samhita Nidana sthana while explaining Gridhrasi nidana¹⁹. It is explained that one is Uparibhagagata to each Anguli and the other is Adhobhagagata to Parshni. Here too the commentator emphasizes that kandara is Maha Snayu.

Greevagata Kandara – These are 4 in number. These are described as Greevahridaya nibandhini (binding) and the extent is below in medra and above in the Mastaka (head) region¹⁷.

Prishthagata Kandara – These are 4 in number. These are described as Shroniprishta nibandhini (binding) and the extent is below in the Nitamba and above in Vaksho mandalam¹⁷.

Since these Kandas are mentioned after the brief discussion on twak, kala, and Bahya srotas, it can be considered that an explanation is given of the structures of the body from the superficial to deep. The kandara should be prominent or large Snayu's which are seen after the removal of skin and related structures. The dissection of cadaver done in which the whole skin is reflected, and the musculature cleaned and a view on the structures revealed has given a good insight in to the Shodasha Kandas explained. The above regions were observed as a whole

to view the extent of white fibrous structure before finer dissection was done.

In the limbs, the two Kandas are prominent fibrous structure seen anteriorly and posteriorly. A view on these fibrous structures as a whole exactly resembles as below extending towards the fingers and above extending to the Bahusira/amsa region (shoulder) or sthana region (pectoral region) in upper limb and uru region (thigh/hip) in the lower limb. In the upper limb the two Maha Snayu are the flexor muscle tendons anteriorly and extensor muscle tendons posteriorly. These tendons appear as a single structure distally before they are separated in to the digits and above appear to be continuous with the triceps tendon extending towards the shoulder. In the lower limb, the two Maha Snayu are extensor group muscles tendon anteriorly and Achilles tendon posteriorly. Here too they seem to be continuous with the iliotibial tract extending to the thigh region.

In the Prishta, the 4 Maha Snayu visible are related to two big muscles on either side of the vertebral column. They are below the latissimus dorsi which extends from the Prishta (vertebral column), Nitamba (buttock) and to the Vaksha mandalam (back of shoulder and scapular region) and above the trapezius extending from the Prishta (vertebral column) to the Vaksha mandalam (scapular region).

The explanations regarding the Kandas of greeva are just not restricted to the neck region. The whole of anterior surface of the trunk and neck has been considered while explaining the extent of these Kandas. They are generally classified as Snayu's which lie below the neck and above the neck. Below they are explained as Greevahridaya nibandhini, which means the one which binds or extends over the neck and chest. Dissection of this region did not reveal any Snayu which extent from the neck downwards, though the aponeurosis of the anterior abdominal wall muscles including the rectus muscle extends from the 5th rib which is the chest region (Hridaya Mandala) and extends below till the pubic region or medra. The anterior abdominal wall Aponeurosis and the Linea alba is undoubtedly a Maha Snayu. Considering the two sides, the 2 Maha Snayu below is the Aponeurotic structure on either side which meet at the Linea alba. Above the neck, the prominent Snayu visible which extent from the greeva to the Mastaka (skull) is the Sternocleidomastoid.

Sushirasnayu

As previously discussed, the word Sushira means a cavity in a hard structure. So, Sushirasnayu is one which is present at a Sushira. Sushirasnayu is said to be present in amashaya anta, pakwashaya anta, and Mutrashaya anta²⁰.

The word Ashaya means a base, seat of Koshta, or which is an adhishtana^{21,22}. According to the classics amashaya is the seat of Ama anna²³. Amashaya is located in between nabhi and sthana²⁴. In the context of grahani in Ashtanga Hridaya it has been said that the food is retained in the amashaya for a certain period of time in the normal physiology²⁵. This explanation is relevant to stomach which is undoubtedly an Ashaya where the food is retained for a certain period of time for proper digestion and the release of food is also in a restricted manner depending on the type of food, which is mostly the physiology of digestion. The end part of stomach is the pyloric canal which terminates as the pyloric orifice. Pyloric canal is a Sushira and also the terminal part of amashaya which makes it the site where Sushirasnayu is present.

Arunadatta defines pakwashaya as the seat of Pakwanna or anna which has attained the form of pureeshata²³. Pakwashaya is

situated below Pittashaya and is stated to be different from unduka²². The anta bhaga of pakwashaya is guda or Gudantra which is defined as 4 ½ Anguli long which has 3 vali and terminates at the Gudoushta. The 3 vali are Pravahini, Visarpini, and samvarini 1 ½ Angulas each from above below²⁶. Beyond this is the Gudoushta which extends till the hairy border. According to these explanations pakwashaya anta is relevant to the terminal part of large intestine as per the comprehensive science. The terminal part of large intestine is the anal canal which terminates at the anal verge. The anal canal is a Sushira and also the terminal part of pakwashaya which makes it the site where Sushirasnayu is present.

Vasthi is said to be the seat of mutra or a place where mutra is present or where mutra is held or stagnated the location of which according to Acharya Vagbhata is middle of kati²⁷. It is an organ which is bending like a bow and has only one opening directed downwards. These descriptions are relevant to urinary bladder explained in the comprehensive science the end portion of which has to be given separate considerations in regard to the male and female considering the difference in anatomical appearance. In females, the bladder neck is obviously the Mutrashaya anta below which we do not find the urine stagnated in normal physiology.

When it comes to the male urinary bladder, due to the difference in anatomical structure and function according to the comprehensive science the Mutrasayanta can be either the bladder neck or the membranous urethra. Here relevant references from Sushruta Samhita Uttara tantra 58th chapter are considered. In the explanation of Vatashtila, it is mentioned that a Granthi which lies in between the Vasti and Shakrutmarga causes obstruction of urine²⁸. The symptoms of this are relevant to enlargement of prostate gland. This reference hints that structurally Vasti includes the prostatic part of urethra too which is the most dilated part of the urethra according to modern anatomy. In the context of Mutrotsanga there is clear description of the structure continued from the Vasti²⁹. Here Acharya mentions about Nala and Mani. Nala is the part which lies in the medra and Mani is its tip. This explanation substantiates that nala is the penile urethra above which was considered as part of the Vasti. Coming to the function, in the context of mutra shukra, Acharya explains that if a person when having the urge to micturate thinks about maithuna or ejaculates, he will pass urine mixed with Shukra. Shukra can enter the urinary tract only in the prostatic region³⁰. This reference clarifies that Acharya has considered the part below the prostatic urethra as the area which can hold urine. A view of the sagittal section of pelvic contents of human body shows the prostatic urethra as having smaller diameter than the urinary bladder but completely constricted at the membranous urethra which looks like the vasthianta. Based on these, the Mutrashaya anta in the male urinary bladder is the membranous urethra.

In this view, the terminal part of Vasthi or Mutrasayanta is the bladder neck in females and the membranous part of urethra in males, which is a Sushira and makes it the site where Sushirasnayu is present.

Structurally, these three sites are peculiar by the presence of sphincter muscles. These are thickened bands of circular muscles which are felt as a hard structure at these sites. They are functionally much stronger than the circular muscles found as a continuation in the extent of digestive and urinary tracts. These sites are felt as thicker and harder in comparison to its continuation. Sphincter muscles can be considered as Sushirasnayu owing to its similarity in function and structural hardness and strength.

The function of Snayu is to bind and thereby help in weight bearing. The Sushirasnayu (sphincters) of the above-mentioned sites functionally helps in preventing the movement of contents of its respective Ashaya further below. These structures are always constricted and bear the weight of its contents above against pressure.

Snayu as Mastulunga Mula

In Kashyapa Samhita, Snayu is mentioned as Mastulunga mula³¹. Acharya Dalhana defines Mastulunga as Mastaka majja which is in the form of partially melted ghee³². This refers to the brain which is a very soft structure and does not fit in to the structural explanation of Snayu. An observation of the related structures was done which includes the meninges of the brain. Among the 3 meninges of brain, duramater is a fibrous structure which is the toughest among the meninges. Duramater plays an important role as a protective covering as well as a binding structure; according to Acharya Sharangadhara, Snayu helps in binding medas too which is discussed early. Mastulunga is also referred as majja which is a type of medas. As the fibrous limiting membrane of brain and having the function of binding, duramater can be considered as Snayu which is referred to as Mastulunga mula.

Snayu Jalam

The only reference on this structure available is that it is 4 in number present in the two Manibandha and two Gulpha, further explained as connected with each other and forms windows in between³³. The word Jalam means a net. The Snayujalam can be said to be a fibrous structure which appears like a network which are interconnected at different points and has spaces in between like windows. The explanation of Snayujalam fits with Retinaculum present in the wrist and ankle. These are condensation of deep fascia which acts as a pulley in the functioning of forearm muscles. Even though they appear superficially they send down slips deeper attached to the bones and there by forming compartments through which specific muscles pass. These slips give a network of attachments forming window like compartments.

CONCLUSION

Understanding the anatomic significance of terms mentioned in the Samhita is need of the time. Incongruence in correlating structures mentioned in the Ayurvedic texts to modern anatomy hinders critical thinking among students. This study of structural correlation of Snayu based on literary review and observation proves that Snayu is a fibrous structure in the body. The classification of Snayu – Prathanavati correlates to muscle tendons in the distal parts of limbs, Prithula resembles Aponeurosis of trunk and scalp, vritha Snayu may be correlated to bigger tendons of muscles like Achilles tendon which has rounded contour, Sushirasnayu are sphincter muscles present in the stomach, anus and urinary bladder. Shodasha Kandara mentioned separately is relevant to big fibrous structure irrespective of its shape; it may or may not be a vritha Snayu. Snayujalam are Retinacular compartments present solely in the wrist and ankle region. The concept of Snayu is very important while considering Snayu marma as well in regard to Snayugata vikara. The proper understanding of the anatomical structure can open the doors to may be a new view on the Snayugata vikaras and enable a physician in better diagnosis, prognostic evaluation, and effective treatment.

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