IAMJ

INTERNATIONAL AYURVEDIC MEDICAL JOURNAL

Review Article ISSN: 2320-5091 Impact Factor: 6.719

PHYSIO MORPHOLOGICAL UNDERSTANDING OF *SHUSHIRA SNAYU*- A CRITICAL REVIEW

Uma B Gopal[1], Arpitha S[2]

[1]Professor, [2]Final year PG Scholar Department of *Rachana Shareera* SDM College of *Ayurveda* and Hospital, Hassan

Corresponding Author: pg21158@sdmcahhassan.org

https://doi.org/10.46607/iamj3813022025

(Published Online: February 2025)

Open Access

© International Ayurvedic Medical Journal, India 2025

Article Received: 06/01/2025 - **Peer Reviewed:** 30/01/2025 - **Accepted for Publication:** 09/02/2025.

Check for updates

ABSTRACT

Shushira Snayu, a term from *Ayurvedic* classics, requires further research for accurate interpretation due to discrepancies between *Ayurvedic* and contemporary medical views. This review explores and clarifies *Shushira Snayu* by examining *Ayurvedic* texts and comparing them with contemporary anatomical understanding.

Shushira Snayu is one of four types of *Snayu* and is located at the terminal parts of the stomach (*Amashaya*), large intestine (*Pakvashaya*), and urinary bladder (*Mutrashaya*). Different authors have described *Shushira Snayu* as a ligament, sphincter, nervous entity, or valvular band of muscles. Classical texts like *Charaka Samhita* and *Dhanurveda* describe *Snayu* as a strong, fibrous structure used for tying bows, indicating its toughness and fibrous nature. Embryologically, *Snayu* develops from *Sira* during the sixth month of intrauterine life, transforming into a more complex structure.

Comparative analysis suggests that *Shushira Snayu* corresponds to sphincter muscles at the pyloric orifice, anal canal, and urethral sphincters in contemporary anatomy. These muscles are characterised by high collagen and elastin content, contributing to their strength and elasticity. Functionally, *Shushira Snayu* binds and supports by maintaining contraction and regulating the movement of contents within their respective cavities. This aligns with the role of sphincter muscles in controlling the passage of food, faeces, and urine.

In conclusion, *Shushira Snayu* can be identified as sphincter muscles at the terminal parts of the stomach, large intestine, and urinary bladder. This understanding bridges the gap between traditional *Ayurvedic* concepts and

modern anatomical perspectives, providing a comprehensive view of *Shushira Snayu's* role in the human body. Further research and interdisciplinary dialogue are necessary to enhance the clarity and application of these concepts in modern medical practice.

Keywords: *Shushira Snayu, Amashaya, Pakvashaya, Basti*

INTRODUCTION

Anatomical terms as per classics mentioned in the subject of *Shareera Rachana* need further research. There is still a lacuna in interpreting anatomical terms referred to in the classics, such as *Snayu*, particularly *Shushira Snayu*. There is a difference in opinion between *Ayurvedic* classics and contemporary science regarding the concept related to *Shushira Snayu*. There is no adequate structural description of *Shushira Snayu* as per *Ayurveda* classics.

Shushira snayu is one among the four types of *Snayu*, and the location of *Shushira Snayu* is considered to present at the ends of the *Amashaya, Pakvashaya* and *Basti*[1]. As per the various authors of *Rachana Shareera* textbooks, Shushira Snayu is considered a thread-like ligament[2], a sphincter[3] and a nervous entity[4] and also a valvular band of muscles[5]. There is one more reference where *Shushira Snayu* is quoted as present in *Aantra*[6].

The difference of opinion among authors in identifying the specific structural entity led to confusion about whether *Shushira Snayu* has to be considered a threadlike ligament, sphincter, nervous entity, or valvular band of muscles.

REVIEW OF LITERATURE:

Review of literature related to *Snayu*:

Review of *Snayu* in *Vedic* literature*:*

Yajurveda*[7]*:

In *Yajurveda, Snayu* is mentioned once in a mantra recited until a dead body is wholly cremated. *Snayu* is referred to as *Nadi*, encompassing both *Sthula* and *Sukshma Nadi*[7].

Dhanurveda*[8]*:

- In *Dhanurveda*, the term Snayu is mentioned in the context of describing the character of a bowstring, owing to its strength.
- It has been recommended to use the *Snayu* of deer, she-buffalo, or a cow.
- It is further mentioned that the bowstring can also be prepared from other materials or *Sthavara Dravya* without absolute *Snayu*.
- It has been mentioned that bow string can also be prepared from the bark of mature bamboo, and at the advent of Bhadrapada masa, even the bark of *Arka* becomes commendable to prepare bow string.

Brahma Purana*[9]*:

- In *Brahma Purana, Snayu* has been referred to as one of the structural entities of the human body in several contexts.
- Similar to *Ayurvedic* texts, it has been mentioned in *Brahma Purana* that *Snayu* is a "*Pitruja Bhava"*.

Manu Smriti*[10]*:

- *Manu Smriti* describes the body as being structured on the base of *Asthi*, bound by *Snayu*, covered by *Mamsa* and *Shonita*, and finally by the skin.

Vyutpatti* of *Snayu:

- According to *Vachaspathya*

स्त्री लिन्ग |[11]

- According to *Amarakosha*

स्नायुः- स्ना + बाहु कात्उण्(स्त्री)\ आतो युक् लिण्क्कु तोः।[12]

Means that one which is composed of different elements.

- According to Apte, Sanskrit dictionary, *Sabdasagara*

स्नालतशुद्ष् यलतद्षोषोऽनयास्नाउण्।[13]

That which purifies the *Dosha* in its *Snayu.*

स्नालतशुयलतद्षोषोऽनया स्ना + उण्= स्नायुः|[14]

The term *Snayu* is derived from the root *Snaa* [*Snaati*] suffix '*Un*' That which is purified and dried with *Dosha*.

Definition of *Snayu*:

स्नायुरितिशणाकारउपधातुविशेष: येनधनूंषिनह्यन्ते।[15]

- *Snayu* are rope-like structures. It resembles bowstrings.
- It is considered as one among उपधातु.
- *Snayu* is the *Upadhatu* of *Medho Dhatu*.

स्नायवो बन्धनं प्रोक्तं देहे माम्सास्थि मेदसाम्॥[16]

- *Snayu* are binding materials of *Mamsa, Asthi* and *Meda.*

Embryological Development:

मेदसःस्नेहमादाय सिरास्नायुत्वमाप्नुयात् ||

सिराणां तु मृदुः पाकः स्नायूनां च ततः खरः |[17]

- From the *paka* of *Snehamsha* of *Medas* – *Sira* and *Snayu* are forming
- *Mrudu paka* – *Sira*
- *Khara paka* – *Snayu*

षष्ठे केशरोमनखास्थिस्नाय्वादीन्यभिव्यक्तानि बलवर्णोपचयश्च|[18]

- According to *Acharya Vagbhata* in 6th month *Snayu* is formed.

Functions of *Snayu*[19]:

- As a boat consisting of planks becomes capable of carrying a load of passengers in the river after it is tied properly with a bundle of ropes, all the joints in the human body are tied with many *Snayu* by which persons are capable of bearing the load.
- *Snayu* compactly holds together all the parts of the human body.

Classification of *Snayu*[1]:

➢ Based on the location and form or structure,

➢ *Snayu* are of four kinds.

1. *Pratanavati*
2. *Vrutta*
3. *Prithu* and
4. *Shushira.*

Review of literature related to *Shushira Snayu*:

Etymological description:

The term "*Shushira*" is derived from सुषि धातु[20]. According to the *Shabdakalpadruma*, "*Shushira*" is defined as छिद्र युक्त काष्ठं[21], meaning a cavity within a hard structure.

Location of *Shushira Snayu*:

आमपक्वाशयान्तेषु बस्तौ च शुषिराः खलु |[1]

Shushira Snayu (hollow/ring-like) is present at the ends of the *Amashaya*(stomach), *Pakvashaya* (large intestine), and *Basti* (urinary bladder).

Amashaya:

- *Amashaya* is the seat of *Ama Anna*[22].
- Its general location is described as *Nabhistanantharam*[23].
- While explaining *Hridaya Marma*, it is noted to be situated at the *Amashaya Dwara*[24].
- In the context of *Grahani*, it is said that food is retained in the *Amashaya*[25].

Pakvashaya:

- *Pakvashaya* is the seat of *Pakwanna* or *Anna* that has attained the form of *Pureeshata*[22].

***Basti/Mutrashaya*:**

- *Mutrashaya* or *Basti* is the seat for *Mutra*[26].
- While explaining *Basti Marma*, *Acharya Vagbhata* describes *Mutrashaya* as the middle of the *Kati*. It is a structure shaped like a bow, with an opening directed downwards[27]. *Basti* is shaped like *Alabu* (pitcher gourd) and supported by *Sira* and *Snayu.* It is the receptacle of *Mala* and an important seat of *Prana*[28].
- *Basti* is present in the pelvis, consisting of less muscle & blood is the seat of urine. According to *Acharya Sushruta, Basti* is situated in the midst of the umbilicus, back, waist, scrotum, rectum, groin and penis and has one opening(only) and thin skin, placed with its face downward[29].

As per recent authors:

According to the various authors of *Rachana Shareera* textbooks, *Shushira Snayu* is considered a thread-like ligament, sphincter, nervous entity, and valvular band of muscles.

As per contemporary science:

Review of literature related to stomach:

Stomach and Its Parts

The stomach, the widest part of the alimentary tract, is located between the oesophagus and the duodenum. It lies in the upper abdomen, extending from the left upper quadrant downward, forward, and to the right, occupying the left hypochondriac, epigastric, and umbilical areas. The stomach occupies a recess beneath the diaphragm and anterior abdominal wall, bounded on either side by the upper abdominal viscera. The peritoneal surface of the stomach is interrupted by the attachments of the greater and lesser omentum, which define the greater and lesser curvatures and separate the two surfaces.

For descriptive purposes, the stomach is divided into four regions: the fundus, body, pyloric antrum, and pylorus, delineated by arbitrary lines drawn on its external surface. The internal appearance and microstructure of these regions vary somewhat. The dome-shaped fundus projects above and to the left of the cardiac orifice, lying in contact with the left dome of the diaphragm. It is above a horizontal line drawn from the incisura cardiaca to the greater curvature. The body extends from the fundus to the incisura angularis, a constant external notch at the lower end of the lesser curvature. A line drawn from the incisura angularis to an indentation on the greater curvature defines the body's lower boundary. The pyloric antrum extends from this line to the sulcus intermedius, where the stomach narrows to form the pyloric canal (1-2 cm long), terminating at the pyloric orifice[30].

Pyloric Orifice

The pyloric orifice, the opening from the stomach into the duodenum, typically lies 1-2 cm to the right of the midline in the transpyloric plane when the body is supine, and the stomach is empty. The pyloric sphincter is a muscular ring formed by a marked thickening of the circular gastric muscle interlaced with some longitudinal fibres. The circular pyloric constriction on the stomach's surface usually indicates the location of the pyloric sphincter, often marked by a prepyloric vein crossing the anterior surface vertically downward.

The pyloric valve (valvula pylori) is formed by a reduplication of the stomach's mucous membrane, covering a muscular ring composed of a thickened portion of the circular layer of the muscular coat. Some deeper longitudinal fibres tune in and interlace with the circular fibres of the valve[30].

Structure of Pyloric Sphincter[31]:

The pyloric sphincter is composed of two main layers:

1. Circular Muscle Layer: This inner layer of smooth muscle is responsible for the sphincteric action, contracting to close the pyloric orifice and relaxing to open it.
2. Longitudinal Muscle Layer: The outer layer, which is less prominent, aids in the overall motility and movement of the stomach and duodenum.

Physiological Function[32]

The primary physiological functions of the pyloric sphincter include:

1. Regulation of Gastric Emptying: The sphincter opens and closes in response to neural and hormonal signals to ensure that chyme is released into the duodenum at an optimal rate for digestion and absorption[34].
2. Prevention of Duodenogastric Reflux: By maintaining a closed state, the sphincter prevents the backflow of bile and digestive enzymes from the duodenum into the stomach, protecting the gastric mucosa from potential damage[33].

Neural and Hormonal Control

Both neural and hormonal mechanisms regulate the activity of the pyloric sphincter:

1. Neural Control: The enteric and autonomic nervous systems coordinate the contraction and relaxation of the sphincter. Vagal stimulation generally promotes relaxation, while sympathetic stimulation induces contraction[32].

2. Hormonal Control: Various gastrointestinal hormones influence the function of the pyloric sphincter. Gastrin, produced by the stomach's G-cells, promotes relaxation, facilitating gastric emptying. Conversely, cholecystokinin (CCK) and secretin, released by the small intestine, inhibit gastric emptying by promoting sphincter contraction[35].

Clinical Significance

Dysfunction of the pyloric sphincter can lead to several clinical conditions:

1. Pyloric Stenosis: A condition characterised by hypertrophy of the pyloric muscle, leading to obstruction of gastric emptying. It is commonly seen in infants and presents with projectile vomiting[32].

2. Gastroparesis is when delayed gastric emptying occurs without mechanical obstruction. It is often associated with diabetes mellitus and neurological disorders [34].

3. Duodenogastric Reflux: Inadequate closure of the pyloric sphincter can result in the reflux of bile and pancreatic secretions into the stomach, causing gastritis and peptic ulcers[35].

Rectum:

Features

The rectum is the distal part of the large gut. It is placed between the sigmoid colon above and the anal canal below. Distension of the rectum causes the desire to defecate. The rectum in man is not straight, as the name implies.

The rectum is curved in an anteroposterior direction and from side to side. The three cardinal features of the large intestine, e.g., sacculations, appendices epiploic ae, and taeniae, are absent in the rectum[36].

Situation

The rectum is situated in the posterior part of the lesser pelvis, in front of the lower three pieces of the sacrum and the coccyx[36].

Extent

The rectum begins as a continuation of the sigmoid colon at the level of the third sacral vertebra. The rectosigmoid junction is indicated by the lower end of the sigmoid mesocolon. The rectum ends by becoming continuous with the anal canal at the anorectal junction. The junction lies 2 to 3 cm in front of and a little below the tip of the coccyx. In males, the junction corresponds to the apex of the prostate[36].

Dimensions

The rectum is 12 cm long. The upper part has the same diameter of 4 cm as the sigmoid colon, but the lower part is dilated to form the rectal ampulla[36].

Course and Direction

The rectum runs first downwards and backwards, then downwards, and finally downwards and forwards.

The rectum's beginning and end lie in the median plane, but its course shows two types of curvatures.

- Two anteroposterior curves:

a. The sacral flexure of the rectum follows the concavity of the sacrum and coccyx.

b. The perineal flexure of the rectum is the backward bend at the anorectal junction

- Three lateral curves:

a. The upper lateral curve of the rectum is convex to the right.

b. The middle lateral curve is convex to the left and is most prominent.

c. The lower lateral curve is convex to the right[36].

Mucosal Folds

The mucous membrane of an empty rectum shows two types of folds—longitudinal and transverse. The longitudinal folds are transitory. They are present in the lower part of an empty rectum and are obliterated by distension. The transverse or horizontal folds, Houston's valves, or plicae transversals are permanent and most marked when the rectum is distended.

a. The first transverse fold lies near the upper end of the rectum and projects from the left wall situated 7.5 cm above the anus. Sometimes, it may encircle and partially constrict the lumen.

b. The second transverse fold, the most significant and constant, lies at the upper end of the rectal ampulla and projects from the anterior and right walls.

c. c. The third transverse fold, which is inconstant, lies 2.5 cm below the third fold and projects from the left wall[36].

Nerve Supply

1. The rectum is supplied by both sympathetic (L1, 2) and parasympathetic (S2, 3, 4) nerves through the superior rectal or inferior mesenteric and inferior hypogastric plexuses.
2. Sympathetic nerves are vasoconstrictors, inhibitory to the rectal musculature and motor to the internal sphincter. Parasympathetic nerves are motor to the musculature of the rectum and inhibitory to the internal sphincter.
3. Sensations of distension of the rectum pass through the parasympathetic nerves, while both the sympathetic and parasympathetic nerves36 carry pain sensations.

Anal Canal:

The anal canal is the terminal part of the gastrointestinal tract and is situated below the level of the pelvic diaphragm. It lies in the anal triangle of the perineum in between the right and left ischioanal fossae, which allows its expansion during the passage of the faces. The sacculations and taeniae are also absent here37.

Length, Extent and Direction

The anal canal is 3.8 cm long. It extends from the anorectal junction to the anus. It is directed downwards and backwards. The anal canal is surrounded by inner involuntary and outer voluntary sphincters, which keep the lumen closed in the form of an anteroposterior slit.

The anorectal junction is marked by the forward convexity of the perineal flexure of the rectum and lies 2–3 cm in front of and slightly below the tip of the coccyx. Here, the ampulla of the rectum suddenly narrows and pierces the pelvic diaphragm. In males, it corresponds to the level of the apex of the prostate.

The anus is the surface opening of the anal canal, situated about 4 cm below and in front of the coccyx in the cleft between the two buttocks. The surrounding skin is pigmented, thrown into radiating folds, and contains a ring of large apocrine glands[37].

Interior of the Anal Canal

The interior of the anal canal shows many essential features and can be divided into three parts: The upper part is about 15 mm long, the middle part is about 15 mm long, and the lower part is about 8 mm long. Each part is lined by a characteristic epithelium and reacts differently to various diseases of this region[37].

Upper Mucous Part

1. This part is about 15 mm long. It is lined by mucous membrane and is of endodermal origin.
2. The mucous membrane shows:

a. 6 to 10 vertical columns or folds; these folds are called the anal columns of Morgagni. These contain radicles of the superior rectal vein.

b. The lower ends of the anal columns are united to each other by short transverse folds of mucous membrane; these folds are called the anal valves.

c. Above each valve, there is depression in the mucosa, which is called the anal sinus.

d. The anal valves, together, form a transverse line that runs all around the anal canal. This is the pectinate line/dentate line. It is situated opposite the middle of the internal anal sphincter, the junction of the ectodermal and endodermal parts. Occasionally, the anal valves show epithelial projections called anal papillae. These papillae are remnants of the embryonic anal membrane.

e. The anal sinus contains anal glands. The secretion of these glands produces a peculiar smell, which is essential in lower animals to attract 37.

Middle Part or Transitional Zone or Pecten

1. The next 15 mm of the anal canal is also lined by mucous membrane, but anal columns are not present here. The mucosa has a bluish appearance because of a dense venous plexus that lies between it and the muscle coat. The mucosa is less mobile than in the upper part of the anal

canal. This region is referred to as the pecten or transitional zone. The lower limit of the pecten often has a whitish appearance, referred to as the white line of Hilton. Hilton's line is situated at the level of the interval between the subcutaneous part of the external anal sphincter and the lower border of the internal anal sphincter.

2. It marks the lower limit of pecten or stratified squamous epithelium, which is thin, pale, glossy, and devoid of sweat glands[37].

Lower Cutaneous Part

It is about 8 mm long and is lined by true skin containing sebaceous glands. The epithelium of the lowest part resembles that of pigmented skin in which sebaceous glands, sweat glands and hair are present [37].

The musculature of the Anal Canal

Anal Sphincters

The anal sphincters are located at the distal end of the rectum, forming a muscular ring around the anal canal. The internal anal sphincter is situated within the wall of the anal canal, while the external anal sphincter surrounds the anal canal and extends distally to the perianal skin[38].

Internal Anal Sphincter

1. Location: The internal anal sphincter is situated within the wall of the anal canal[38]
2. Structure: The internal anal sphincter is composed of smooth muscle fibres and is an involuntary muscle. It is a thickening of the circular muscle layer of the rectum, approximately 2.5 to 4 cm in length[39].
3. Function: The internal anal sphincter maintains baseline anal tone and prevents involuntary leakage of stool and gas. It is responsible for about 70-85% of resting anal tone[40].

External Anal Sphincter

1. Location: the external anal sphincter surrounds the anal canal and extends distally to the perianal skin[38].
2. Structure: The external anal sphincter is composed of skeletal muscle fibres and is a voluntary muscle. It is cylindrical and surrounds the internal anal sphincter, extending from the tip of the coccyx to the perineal body 41.
3. Function: The external anal sphincter provides voluntary control over defecation. It contracts in response to the urge to defecate or in situations requiring the retention of faeces, providing a critical backup to the internal sphincter[42].

Physiological Function

The physiological function of the anal sphincters involves the coordinated activity of both internal and external sphincters to maintain continence and allow for the controlled release of faeces. The internal anal sphincter maintains a constant tone, while the external sphincter provides additional support during activities that increase intra-abdominal pressure, such as coughing or sneezing[43].

Neural Control

A combination of autonomic and somatic nervous systems regulates the function of the anal sphincters.

1. Internal Anal Sphincter: The internal anal sphincter is primarily controlled by the autonomic nervous system. Sympathetic innervation via the hypogastric plexus enhances sphincter contraction, while parasympathetic innervation via the pelvic splanchnic nerves induces relaxation[44].
2. External Anal Sphincter: The external anal sphincter is under somatic control, primarily via the pudendal nerve. The pudendal nerve innervates the sphincter and provides voluntary control over its contractions, allowing conscious regulation of defecation[45].

Clinical Significance

Dysfunction of the anal sphincter complex can lead to various clinical conditions:

1. Fecal Incontinence The internal anal sphincter is crucial for maintaining faecal continence by providing constant baseline pressure. Dysfunction, such as in neurogenic injury or scarring, can decrease resting anal pressure, leading to faecal incontinence[46].

2. Anal Fissures: Anal fissures are tears in the lining of the anal canal, often occurring due to high anal pressure from a hypertonic internal anal sphincter. This increased tone reduces blood flow, impairing healing and perpetuating the fissure[47].
3. Hemorrhoids: Hemorrhoids are swollen veins in the lower rectum and anus. Increased intra-abdominal pressure and straining can lead to the protrusion of hemorrhoidal tissue, which may be exacerbated by a dysfunction in the external anal sphincter, impairing the regulation of venous pressure 48.

Anorectal Ring

This is a muscular ring present at the anorectal junction. It is formed by the fusion of the puborectalis, the uppermost fibres of the external sphincter and the internal sphincter. It is easily felt by a finger in the anal canal. The surgical division of this ring results in rectal incontinence. The ring is less marked anteriorly where the fibres of the puborectalis are absent 49.

URINARY BLADDER:

Features

The urinary bladder is a muscular reservoir of urine in the anterior part of the pelvic cavity. The detrusor muscle of the urinary bladder is arranged in whorls and spirals and is adapted for mass contraction rather than peristalsis[50].

Size, Shape and Position

The bladder varies in size, shape and position according to its urine content.

When empty, it lies entirely within the pelvis, but as it fills, it expands and extends upwards into the abdominal cavity, reaching up to the umbilicus or even higher [50].

External Features[50]

An empty bladder is tetrahedral in shape and has:

1. Apex directed forwards.
2. Base or funds directed backwards.
3. Neck, which is the lowest and most fixed part of the bladder.
4. Three surfaces, superior, right and left inferolateral.
5. Four borders, two lateral, one anterior and one posterior.

A full bladder is ovoid and has:

1. An apex directed upwards towards the umbilicus.
2. A neck directed downwards.
3. Two surfaces—anterior and posterior.

Relations[50]

1. The apex is connected to the umbilicus by the median umbilical ligament, representing the obliterated embryonic urachus.
2. Base:

a. In the female, it is related to the uterine cervix and the vagina.

b. In the male, the upper part of the base is separated from the rectum by the rectovesical pouch and the contained intestine coils; the lower part is related to the seminal vesicles and the terminations of the vas deferens. The triangular area between the two-ductus deferens is separated from the rectum by the rectovesical fascia of Denon Villiers.

3. The neck is the bladder's lowest and most fixed part. It lies 3 to 4 cm behind the lower part of the pubic symphysis, a little above the plane of the pelvic outlet. It is pierced by the internal urethral orifice.

a. In males, smooth muscle bundles surround the bladder neck and preprostatic urethra. These are arranged as distinct circular collars with their distinct adrenergic innervations. This is the preprostatic sphincter and is devoid of parasympathetic cholinergic nerves. It is part of the proximal urethral sphincter mechanism.

b. In females, the neck is related to the pelvic fascia, which surrounds the upper part of the urethra. In infants, the bladder lies at a higher level. The internal urethral orifice lies at the level of the superior border of the pubic symphysis. It gradually descends to reach the adult position after puberty.

4. Superior surface:

a. In males, it is entirely covered by the peritoneum and is in contact with the sigmoid colon and coils of the terminal ileum.
b. In females, the peritoneum covers the more significant part of the superior surface, except for a small area near the posterior border related to the supravaginal part of the uterine cervix. The peritoneum from the superior surface is reflected in the isthmus of the uterus to form the vesico uterine pouch.
5. Inferolateral surfaces: These are devoid of peritoneum and are separated from each other anteriorly by the anterior border and from the superior surface by the lateral borders.
a. In the male, each surface is related to the pubis, the puboprostatic ligaments, the retropubic fat, the levator ani and the obturator internus.
b. In the female, the relations are the same, except that the puboprostatic ligaments are replaced by the pubovesical ligaments.

As the bladder fills, the inferolateral surfaces form the anterior surface of the distended bladder, which is covered by the peritoneum only in its upper part. The lower part comes into direct contact with the anterior abdominal wall, and there is no intervening peritoneum. This part can be approached surgically without entering the peritoneal cavity.

Ligaments of the Bladder[50]

True Ligaments

These are condensations of pelvic fascia around the neck and base of the bladder. They are continuous with the fascia on the superior surface of the levator air.

1. The lateral true ligament of the bladder extends from the side of the bladder to the tendinous arch of the pelvic fascia.
2. The lateral puboprostatic ligament is directed medially and backwards. It extends from the anterior end of the tendinous arch of the pelvic fascia to the upper part of the prostatic sheath.
3. The medial puboprostatic ligament is directed downwards and backwards. It extends from the back of the pubic bone (near the pubic symphysis) to the prostatic sheath. The ligaments of the two sides form the floor of the retropubic space. In females, bands similar to the puboprostatic ligaments are called the pubovesical ligaments. They end around the neck of the bladder.
4. The median umbilical ligament is the remnant of the urachus.
5. The posterior ligament of the bladder is directed backwards and upwards along the vesical plexus of veins. It extends on each side from the base of the bladder to the wall of the pelvis.

False Ligaments

These are peritoneal folds, which do not form any support to the bladder.

They include:

1. Median umbilical fold
2. Medial umbilical fold
3. Lateral false ligament, formed by the peritoneum of the paravesical fossa.
4. Posterior false ligament, formed by peritoneum of the Sacro genital folds.

Urethral Sphincter

The urethral sphincter is a critical anatomical structure that controls the release of urine from the bladder. It consists of two main components: the internal urethral sphincter and the external urethral sphincter. These sphincters play a crucial role in the voluntary and involuntary control of urination.

Internal Urethral Sphincter

1. Location:

It is located at the junction of the bladder and urethra. In males, it is found at the base of the urinary bladder, surrounding the internal urethral orifice. Although less distinct in females, it is situated in the same region and serves a similar function[51].

2. Structure:

Composed of smooth muscle fibres, this sphincter is involuntary. In males, it is circular and well-defined. In females, the muscle fibres are less organized but still function as a sphincter[52].

3. Function: Prevents the involuntary release of urine from the bladder. In males, it also prevents

the retrograde ejaculation of semen into the bladder[53].

External Urethral Sphincter

1. Location:

Found distally along the urethra. In males, it surrounds the membranous urethra, whereas in females, it is located at the mid-urethra. It is part of the urogenital diaphragm[54].

2. Structure:

This sphincter, made of striated muscle, is voluntary and surrounds the urethra. It provides conscious control over urination[55].

3. Function:

Provides voluntary control over urination, allowing individuals to hold or release urine consciously[56].

Physiological Function

The urethral sphincters play a critical role in storing and releasing urine. The internal sphincter maintains continence by keeping the urethra closed during the filling phase, while the external sphincter allows voluntary control during micturition. Coordination between these sphincters ensures proper bladder function[57].

1. Continence: The internal sphincter maintains a baseline level of contraction to prevent urine leakage. The external sphincter provides an additional control layer, particularly during activities that increase intra-abdominal pressure, such as coughing or sneezing.

2. Micturition: During urination, the bladder's detrusor muscle contracts, and the internal sphincter relaxes. The external sphincter is then voluntarily relaxed, allowing urine to flow through the urethra.

Neural Control

A complex interplay of neural mechanisms regulates the function of the urethral sphincters:

1. Autonomic Nervous System:

The autonomic nervous system controls the internal urethral sphincter (sympathetic control through hypogastric nerves causing contraction and parasympathetic control via pelvic nerves leading to relaxation)[58].

2. Somatic Nervous System:

The external urethral sphincter is innervated by the pudendal nerve, which is part of the somatic nervous system and allows voluntary control[59].

Clinical Significance

Dysfunction of the urethral sphincter can lead to various clinical conditions:

1. Urinary Incontinence: Dysfunction of the external sphincter can lead to stress urinary incontinence, especially in females, often due to weakened pelvic floor muscles[60].

DISCUSSION

Discussion based on *Vedic* literature:

It can be interpreted that during cremation, *Snayu* is considered a hard, strong structure that requires the mantra for proper burning. *Snayu* is binding *Asthi* (bones) and *Mamsa* (muscle).

Understanding the term *Snayu* based on the description given in *Charaka* and *Dhanurveda*:

- *Acharya Charaka* mentions that *Snayu* is *Shanakara. Snayu* is used to tie a bow and as a *Seevana Dravya.*
- *Dhanurveda* mentions similar substances which can be replaced as *Snayu*. In explaining the making of the bow, the author has stated that *Snayu* is the material of choice for tying the bow. Still, if unavailable, materials like *Vamsha Twak* and *Arka Twak* can be used for the same purpose.
- Detailed observation of these structures reveals them as generally fibrous structures which are strong enough to withstand a certain amount of tension.
- An overall observation of these structures gives the impression that *Snayu* is a fibrous structure visible in the body.

Understanding the structural entity of *Snayu* based on embryological implication:

- As per classical texts, *Snayu* develops during the 6th month of intrauterine life.

- It arises from the transformation of *Sira*, which loses its softness *(Mridutva)* and gains a tougher *(Khara)* texture.
- Contemporary science does not provide detailed references on the development of *Snayu*.
- However, a research paper on the early development of the knee joint in staged human embryos indicates that blood vessels are visible in the ligaments and menisci of the knee joint during embryonic life.
- During development, tendons are richly supplied with capillaries, as young tendons are more cellular and require more nourishment than mature, less cellular tendons.
- In adults, ligaments are less vascular, suggesting that these blood vessels either degenerate or transform into fibrous structures.

Shushira Snayu

- *Shushira Snayu* refers to structures present at a *Shushira*, which means a cavity in a hard structure.

Sites of *Shushira Snayu:*

- *Shushira Snayu* is found in the terminal parts of the stomach *(Amashaya Anta)*, large intestine *(Pakvashaya Anta)*, and urinary bladder *(Mutrashaya Anta).*

1. *Amashaya Anta* (Terminal Part of the Stomach)

- Location: The *Amashaya*, identified as the stomach, is situated between the navel *(Nabhi)* and the chest *(Stana).*
- Function: It serves as the seat of partially digested food *(Ama Anna)*, retaining food for digestion.
- Structure: The terminal part of the stomach is the pyloric canal, ending at the pyloric orifice, which is a *Shushira*. This makes it a site for *Shushira Snayu.*

2. *Pakvashaya Anta* (Terminal Part of the Large Intestine)

- Location: The *Pakvashaya*, equated to the large intestine, is below the *Pittashaya* and distinct from the *Unduka.* The terminal part, *Gudantra*, extends to the anal verge.
- Function: It serves as the seat of processed food *(Pakwanna* or *Pureesha).*
- Structure: The anal canal is the terminal part and a *Shushira,* making it a site for *Shushira Snayu.*

3. *Mutrashaya Anta* (Terminal Part of the Urinary Bladder)

- Location: The bladder *(Basti)* is situated in the middle of the pelvis and has one opening directed downward.
- Function: It is the reservoir of urine.
- Structure in Females: The bladder neck is the terminal part where urine is held.
- Structure in Males: Due to anatomical differences, the terminal part can be either the bladder neck or the membranous urethra. The prostatic urethra is also considered as part of the *Basti* and is where urine can mix with semen *(Shukra)* during ejaculation.
- In summary, the terminal parts of the stomach, large intestine, and urinary bladder (in both males and females) are the sites where *Shushira Snayu* is present. These locations, characterized by their cavity-like structures, align with the classical descriptions of *Shushira Snayu.*

Structural Aspects of *Shushira Snayu*

- The three sites where *Shushira Snayu* are located are notable for the presence of sphincter muscles.
- These muscles are thickened bands of circular muscles, felt as hard structures at these sites.
- They are functionally stronger than the circular muscles found elsewhere in the digestive and urinary tracts. Additionally, the smooth muscles in these sphincter regions have a higher concentration of collagen and elastin fibers, which contribute to their strength while maintaining elasticity.
- These fibers are key components of connective tissue, forming fibrous structures in the human body. Thus, these sphincter muscles are thicker and harder compared to the surrounding muscles.

- Given their structural hardness and strength, sphincter muscles can be considered as one of the components of *Shushira Snayu.*

Functional Aspects of *Shushira Snayu*

- *Snayu* primary function is to bind and support weight bearing.
- Sphincter muscles exhibit this binding function by remaining constricted, thereby supporting the weight of the contents above them.
- The *Shushira Snayu* (sphincters) at the mentioned sites effectively prevent the movement of contents to lower regions, ensuring proper control and regulation within their respective *Ashaya.*
- Thus, functionally, sphincters can be substantiated as one of the components of *Shushira Snayu* due to their role in binding and weight bearing.

CONCLUSION

Based on the detailed review and discussion done both as per *Ayurveda* and contemporary science, Functionally, *Snayu* serves to bind and support weight bearing by maintaining contraction. *Shushira snayu*, which is considered one among *Snayu* is associated with supporting and preventing the movement of contents to lower region or expulsion and ensures proper control within their respective *Ashaya* (cavities) till the contents are ready for passing into next segment or result in erg for expulsion. Thus, the regulation of these sphincters is predominantly controlled by the Autonomic nervous system with significant input from the Enteric and Somatic nervous systems. The interplay between these nervous systems ensures the proper functioning of the Muscular element which are fibrous in nature, highlighting the intricate connection between the structural and functional aspects of *Shushira Snayu.*

Hence *Shushira Snayu* present in relation to *Amashaya* can be taken as Pyloric sphincter with its autonomic connection in opening and closure and act as gateway for *Anna* passing from stomach to small intestine. It maintains a time interval, so that the food undergoes enzyme activity and converted into homogenous paste, and ready for passing through next phase of digestion as and when it reaches proximal part of small intestine.

Shushira Snayu present in relation to *Pakvashaya* can be taken as internal and external Anal Sphincters with its autonomic and somatic control performing the function of defecation and maintains the integrity of Alimentary tract especially anorectal canal.

Shushira Snayu present in relation to *Basti* can be taken as Internal and External Urethral sphincters with its autonomic and somatic control respectively performing the function of reservation of urine within urinary bladder and its timely expulsion based on the capacity of bladder and signs of urge for micturition.

REFERENCES

1. Acharya JT. Sushruta Samhita with Nibandhasangraha commentary of Dalhana. Reprint ed. Varanasi (India): Chaukambha Sanskrit Sansthan; 2010. p.367.
2. Kanti G M. A Textbook of Ayurvedic Human Anatomy.1st ed. Varanasi: Chaukhambha Orientalia;2015: 54.
3. Acharya JT. Sushruta Samhita with Nibandhasangraha commentary of Dalhana. Reprint ed. Varanasi (India): Chaukambha Sanskrit Sansthan; 2010. p.367.
4. C R Agnives. A Textbook of Ayurvedic Anatomy. M P Praveen, T. Sreekumar(editor)3rd ed. Kerala: Harisree Publications; 2021:61.
5. Sharma T C. Ayurvediya Shareera Rachana vignana. Haryana: Natha Pusthaka Bhandara;203.
6. C R Agnives. A Textbook of Ayurvedic Anatomy. M P Praveen, T. Sreekumar (editor)3rd ed. Kerala: Harisree Publications; 2021:59.
7. Sanskrit web. Yajurveda [Internet]. c2005[cited 28 July 2024]. Available at: http://www.sanskritweb.net/yajurveda/ (Accessed:08/11/2024)
8. Pages Inventory. Dhanurveda [Internet]. c2011[28 July 2024]. Available at: http://www.atarn.org/india/Dhanurveda.pdf(Accessed:08/11/2024)

9. Maharshi University of Management. Puran[Internet]. c2010[28 July 2024]. Available at: http://is 1.mum.edu/vedicreserve/puranas/brahma_purana.pdf (Accessed:08/11/2024)
10. Maharshi University of Management. Smriti[Internet]. c2010[28 July 2024]. Available at: http://is 1.mum.edu/vedicreserve/smriti/15Manu_Smriti.pdf. pdf (Accessed:08/11/2024)
11. Taranatha Tarkavachaapati.Vachaspatyam.3rd ed. Varanasi (India): Chaukambha Sanskrit Series;1970.p.232
12. Pandit. Harigovinda Shastri. Amarakosha with Ramasrami (vyakhyasudha) commentary of Bhanuji Diksita.4th ed. Varanasi (India): Chaukambha Sanskrit Sansthan; 2010. p. 289.
13. Pandit Ishwar Chandra. Sanskrit-English Dictionary of M. Monier-Williams. Published in collaboration with Parimal Publications; Vol 2, p.1850
14. Prof.C.R Agnives.3rd ed.A textbook of Ayurvedic anatomy, page no; 58
15. Acharya Y.T. Sushruta Samhita with Nibhandhasangraha commentary of Dalhanacharya. 9th ed. Varanasi (India): Chaukambha Sankrit Sansthan; 2007. p.118.
16. Pandit Sharangadhara Acharya, Sharangadhara Samhita Annoted with Dipika Hindi Commentary by Bramanand Tripathi, Varanasi: Chaukhambha Surabharati Prakashaana; Reprint 2010. Chapter 5 Verse 55-page no. 62
17. Acharya JT. Sushruta Samhita with Nibandhasangraha commentary of Dalhana. Reprint ed. Varanasi (India): Chaukhambha Sanskrit Sansthan; 2010. p.367
18. Paradakara HSS. Ashtanga Hridayam with Sarvanga Sundaram of Arunadutta and Ayurveda Rasayana of Hemadri. 9th ed. Varanasi (India): Chaukhambha Sanskrit Orientalia, 2005. 413.
19. Acharya JT. Sushruta Samhita with Nibandhasangraha commentary of Dalhana. Reprint ed. Varanasi (India): Chaukambha Sanskrit Sansthan; 2010. p 367.
20. Sri Raja Radhakantadeva Bahadur: Edited by Sri Varadaprasada Vasu and Sri Haricharan Vasu. Shadakalpadruma Vol V. Varanasi. Published by Chaukhamba Sanskrita Series Office. 2004. P.388.
21. Sri Raja Radhakantadeva Bahadur: Edited by Sri Varadaprasada Vasu and Sri Haricharan Vasu. Shabdakalpadruma Vol V. Varanasi. Published by Chaukhamba Sanskrita Series Office. 2004. P.388.
22. Vagbhata: Ashtanga Hridayam with Arunadatta and Hemadri commentary: Edited by Pt. Bhisagacharya Harishastri Paradkar Vaidya: Published by Chowkhamba Krishnadas Academy, Varanasi: p.387
23. Agnivesha: Charaka Samhita with Ayurveda Dipika commentary of Chakrapanidatta: Edited by Vaidya Jadavji Trikamji Acharya: Published by Chowkhamba Krishnadas Academy, Varanasi: p.240
24. Vagbhata: Ashtanga Hridayam with Arunadatta and Hemadri commentary: Edited by Pt. Bhisagacharya Harishastri Paradkar Vaidya: Published by Chowkhamba Krishnadas Academy, Varanasi: p.410
25. Vagbhata: Ashtanga Hridayam with Arunadatta and Hemadri commentary: Edited by Pt. Bhisagacharya Harishastri Paradkar Vaidya: Published by Chowkhamba Krishnadas Academy, Varanasi: p.394
26. Vagbhata: Ashtanga Hridayam with Arunadatta and Hemadri commentary: Edited by Pt. Bhisagacharya Harishastri Paradkar Vaidya: Published by Chowkhamba Krishnadas Academy, Varanasi: p.410
27. Vagbhata: Ashtanga Hridayam with Arunadatta and Hemadri commentary: Edited by Pt. Bhisagacharya Harishastri Paradkar Vaidya: Published by Chowkhamba Krishnadas Academy, Varanasi: p.410
28. Sushruta: Sushruta Samhita with Dalhana Commentary: Edited by Vaidya Jadavji Trikamji Acharya: Published by Chowkhamba Krishnadas Academy, Varanasi: Reprint 2008: p.279
29. Sushruta: Sushruta Samhita with Dalhana Commentary: Edited by Vaidya Jadavji Trikamji Acharya: Published by Chowkhamba Krishnadas Academy, Varanasi: Reprint 2008: p.373
30. Chaurasia BD. Human Anatomy: Regional and Applied Dissection and Clinical Lower Limb, Abdomen and Pelvis. 6th ed. Vol 2. New Delhi: CBS Publishers & Distributors Pvt Ltd; 2013. Reprint 2015:250-251.
31. Standring S, editor. Gray's Anatomy: The Anatomical Basis of Clinical Practice. 41st ed. Elsevier; 2015. p. 1135-1137.

32. Guyton AC, Hall JE. Textbook of Medical Physiology. 13th ed. Elsevier; 2016. p. 788-790.
33. Berne RM, Levy MN, Koeppen BM, Stanton BA. Berne & Levy Physiology. 7th ed. Elsevier; 2018. p. 586-588.
34. Csendes A, Braghetto I, Burdiles P, Korn O, Diaz JC. Gastric emptying and its clinical implications. World J Surg. 2007;31(8):1466-1474.
35. Singh S, Rezaie A, Lembo A. The Role of Gastric and Intestinal Hormones in the Regulation of Gastric Emptying in Health and Disease. Gastroenterol Clin North Am. 2011;40(1):57-72.
36. Chaurasia BD. Human Anatomy: Regional and Applied Dissection and Clinical Lower Limb, Abdomen and Pelvis. 6th ed. Vol 2. New Delhi: CBS Publishers & Distributors Pvt Ltd; 2013. Reprint 2015:407-411.
37. Chaurasia BD. Human Anatomy: Regional and Applied Dissection and Clinical Lower Limb, Abdomen and Pelvis. 6th ed. Vol 2. New Delhi: CBS Publishers & Distributors Pvt Ltd; 2013. Reprint 2015:413-414.
38. Standring S, Borley NR, Healy JC, et al., eds. "Gray's Anatomy: The Anatomical Basis of Clinical Practice." 40th ed. London: Churchill Livingstone; 2008. pp. 1149-1151.
39. Lunniss PJ, Phillips RK. "The internal anal sphincter: its physiology and its relevance to the pathogenesis of faecal incontinence." *British Journal of Surgery*. 1992;79(7):762-767.
40. Gibbons CP, Read NW. "Anal incontinence and rectal denervation in the elderly." *Gut*. 1986;27(11):1244-1251.
41. Shafik A, Doss S, Ali Y. "The external anal sphincter: a triple-loop system." *Surgical and Radiologic Anatomy*. 1994;16(2):145-149.
42. Shafik A. "The external anal sphincter: a study of its anatomy and role in the continence mechanism." *Journal of Urology*. 1975;114(2):261-264.
43. Matzel KE, Koebke J, Schmidt RA, et al. "The internal anal sphincter continence reflex." *Diseases of the Colon & Rectum*. 1995;38(7):761-765.
44. Bharucha AE, Wald A, Enck P, et al. "Functional anorectal disorders." *Gastroenterology*. 2006;130(5):1510-1518.
45. Rao SS, Hatfield R, Soffer E, et al. "Manometric assessment of function of anal sphincters in healthy adults." *American Journal of Gastroenterology*. 1999;94(3):773-779.
46. Sultan AH, Kamm MA, Hudson CN, et al. "Anal-sphincter disruption during vaginal delivery." *New England Journal of Medicine*. 1993;329(26):1905-1911.
47. Schouten WR, Briel JW, Auwerda JJ. "Relationship between anal pressure and anodermal blood flow: the vascular pathogenesis of anal fissures." *Diseases of the Colon & Rectum*. 1994;37(7):664-669.
48. Lohsiriwat V. "Hemorrhoids: From basic pathophysiology to clinical management." *World Journal of Gastroenterology*. 2012;18(17):2009-2017.
49. Chaurasia BD. Human Anatomy: Regional and Applied Dissection and Clinical Lower Limb, Abdomen and Pelvis. 6th ed. Vol 2. New Delhi: CBS Publishers & Distributors Pvt Ltd; 2013. Reprint 2015:415.
50. Chaurasia BD. Human Anatomy: Regional and Applied Dissection and Clinical Lower Limb, Abdomen and Pelvis. 6th ed. Vol 2. New Delhi: CBS Publishers & Distributors Pvt Ltd; 2013. Reprint 2015:372-374.
51. Baskin LS, Ebbers MB. Anatomy of the lower urinary tract and male genitalia. Pediatr Clin North Am. 2006;53(3):393-401. doi:10.1016/j.pcl.2006.02.008.
52. DeLancey JO. Structural aspects of the extrinsic continence mechanism. Obstet Gynecol. 1988;72(3):396-401.
53. Andersson KE, Arner A. Urinary bladder contraction and relaxation: physiology and pathophysiology. Physiol Rev. 2004;84(3):935-986. doi:10.1152/physrev.00038.2003.
54. Oelrich TM. The urethral sphincter muscle in the male. Am J Anat. 1980;158(1):51-61. doi:10.1002/aja.1001580106.
55. Singh S, Housami F, et al. Anatomy and innervation of the male urethra: clinical implications. Aust N Z J Surg. 2001;71(10):745-749. doi:10.1046/j.1440-1622.2001.02131. x.
56. Steers WD. Pathophysiology of overactive bladder and urge urinary incontinence. Rev Urol. 2002;4 Suppl 4: S7-S18.
57. Griffiths DJ. The mechanics of the urethra and the effect of drugs on urethral pressure. Br J Urol. 1980;52(6):431-435.
58. de Groat WC, Yoshimura N. Mechanisms underlying the recovery of lower urinary tract function following spinal cord injury. Prog Brain Res.

2006;152:59-84. doi:10.1016/S0079-6123(05)52006-8.
59. Holstege G, Griffiths D, et al. The emotional motor system and micturition control. Neurourol Urodyn. 2010;29(1):42-48. doi:10.1002/nau.20762.
60. Resnick NM, Yalla SV. Detrusor hyperactivity with impaired contractile function. An unrecognized but common cause of incontinence in elderly patients. JAMA. 1987;257(22):3076-3081. doi:10.1001/jama.1987.03390220074026.

Source of Support: Nil
Conflict of Interest: None Declared

How to cite this URL: Uma B Gopal &Arpitha S: Physio morphological Understanding of Shushira Snayu- A Critical Review. International Ayurvedic Medical Journal {online} 2025 {cited February 2025}