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AN ANATOMICAL STUDY OF SUSHRUTOKTA *MAMSAVAHA SROTAS* AND ITS MULASTANA

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ABSTRACT

Background: *Mamsavaha Srotas* are channels responsible for the formation, nourishment, maintenance, and functional integrity of *Mamsa Dhatu*. *Sushruta* identify *Snayu*, *Twaka*, and *Raktavahi Dhamani* as the Mulastana of Mamsavaha Srotas. And its anatomy must be revealed with modern biomedical sciences. **Objective:** To analyse the concept of Mamsavaha Srotas and its Mulastana with contemporary anatomy. **Methods:** A comprehensive literary review was conducted using classical Ayurvedic texts, including Charaka Samhita and Sushruta Samhita etc along with standard modern anatomy, embryology etc references. Comparative analysis was performed to identify structural and functional correlations. **Discussion:** The findings indicate that the *Mulastana* of *Mamsavaha Srotas* collectively represent an integrated Musculo-Neuro-vascular complex responsible for muscular nourishment, stability, protection, and movement. This interpretation provides a scientific basis for understanding Ayurvedic anatomical concepts in the context of modern biomedical knowledge and highlights their clinical relevance in musculoskeletal disorders. **Conclusion:**

The anatomical, physiological, and embryological evidence suggests that *Snayu, Twaka, and Raktavahi Dhamani* represent interconnected connective tissue, integumentary, and vascular structures essential for muscular development, nourishment, protection, and function. Their coordinated organization supports the interpretation of the *Mulastana* of *Mamsavaha Srotas* as an integrated Musculo-neurovascular system, providing a scientific basis for correlating Ayurvedic concepts with contemporary biomedical anatomy.

KEYWORDS: *Mamsavaha*, Musculoskeletal, Neurovascular, *Srotas, Twaka*.

INTRODUCTION

Sophisticated understanding of human biology in which health is maintained through the harmonious integration of structural and functional systems is the objective of *Ayurveda.* Within this framework, *Rachana Sharira* provides the anatomical basis for interpreting bodily organization and function. *Mamsavaha Srotas*, one of the channel systems described in *Ayurveda,* is responsible for the formation, nourishment, maintenance, and functional integrity of *Mamsa Dhatu* thereby contributing to body stability, strength, and locomotion. According to *Acharya Sushruta*, the *Mulastana* of *Mamsavaha Srotas* comprises *Snayu*, *Twaka*, and *Raktavahi Dhamani*. These structures collectively provide biomechanical support, tissue protection, vascular perfusion, and functional coordination essential for musculoskeletal homeostasis. A critical evaluation of these entities from anatomical, physiological, and embryological perspectives is therefore essential to elucidate the scientific basis of *Mamsavaha Srotas* and to facilitate its correlation with contemporary biomedical anatomy and developmental sciences.

OBJECTIVES

1 To study concept of *Mamsavaha Srotas* both ayurvedic and modern perspective

2 To study the *Mulastana* of *Mamsavaha Srotas*

REVIEW OF LITERATURE

The literature was critically reviewed from both classical Ayurvedic and contemporary biomedical perspectives to facilitate a comprehensive comparative analysis.

AYURVEDIC REVIEW

Concept of *Srotasa & Srotomūla*

Etymologically derived from the root *"Sru"* (to flow), *Srotas* represent the biological conduits mediating the systemic translocation of nutritive substrates essential for *Dhatu* sustenance, metabolism, and homeostatic regulation.[1] According to *Sushruta, Srotasa* are microscopic bodily channels originating from spaces within the body that transport and distribute various substances.[2] According to *Charaka, Srotasa* are the channels or pathways responsible for the transport and transformation of Dhatus within the body.[3] *Srotasa* are also described by various synonymous terms such as *Nadi, Pantha, Marga, Sharira Chhidra.*[4] Vayu combined with *Ushma* creates the *srotasa*.[5] *Srotas* are described as hierarchically organized biological conduits, ranging from macroscopic (*Sthula*) to microscopic (*Anu*) dimensions, with their morphological characteristics reflecting the nature of the *Dhatu* they convey. Their intricate, arborizing architecture forms an extensive body-wide network that facilitates the transport, distribution, and metabolic nourishment of tissues, thereby ensuring systemic physiological homeostasis.[6] *Mūlasthāna* represents the primary anatomical substrate and functional control center of a *Srotas*, orchestrating its structural integrity and systemic physiological functions.[7]

Mamsavaha srotas

Mamsavaha Srotas are the channels responsible for the formation, nourishment, transport, and maintenance of *Mamsa Dhatu* throughout the body. **Mamsa dhatu** word is derived from Sanskrit root called "Mans" meaning flesh or meat. After formation, it has predominance of *Prithvi Mahabhuta.*[8] According to *Charaka Samhita*, *Mamsa Dhatu* is formed from *Rakta Dhatu* during the action of *Maṃsagni.* Rakta is processed by *Raktagni* and influenced by *Vayu, Agni*, and *Jala Mahabhutas*, which makes it compact and soft, leading to the formation of *Mamsa Dhatu.*[9] *Mamsa Dhatu* is responsible for nourishment and maintenance of the body and nourishment of *Meda Dhatu*.[10]

Mulastana

" मांसवहानां स्त्रोतसां स्नायुर्मूलं त्वक् च ।" (Ch. Vi. ५/८)

"मांसवहे दे, तयोर्मूलं स्नायुत्वचं रक्तवहाश्च धमन्यः।" (Su.Sha ९ / २२)

According to *Charak, Snayu* and *Twaka* are roots (मूल) of Mamsavaha Srotas.

Sushruta added *Raktavahi Dhamani*. in mamsa dhatu are roots of Mamsavaha Srotas.

Snayu

According to *Acharya Dalhan, snayu* is a special *Upadhatu* just like a rope of a bow, through which a bow is tied tightly.[11] From the unctuous portion of *Meda* both *Sira* and *Snayu* are formed. *Sira* arise from the *mrudupaka* and Snayu from the *kharapaka.* It is because of the *kharapaka* that *Snayu* are firm, strong and unyielding in nature.[12] According to *Ayurveda*, a total of 900 *Snayu* are described in the human body, comprising 600 in the extremities (*Śākhā*), 230 in the trunk (*Koṣṭha*), and 70 in the neck and head region (*Grīvā-Urdhva*). Acharya Sushruta classifies *Snayu* into *Pratanavati*, *Vritta*, *Pruthu*, and *Sushira* types, corresponding functionally to ligaments and nerves, tendons, fascial-aponeurotic structures, and sphincters, respectively. Collectively, *Snayu* constitute the principal connective framework that integrates musculoskeletal components, conferring biomechanical stability, structural cohesion, and locomotor efficiency.[13] Clinical Importance According to Acharya Sushruta, injury to snayu leads to shortening, debility of body parts, inability to perform any action, severe pain and delayed wound healing.[14] According to Acharya Sushruta, aggravated vata residing in snayu gives rise to stiffness of that body part or tremors, pain and convulsions. *Abhyantarayam* is one of the various diseases caused by vata wherein vitiated vata get located in *snāyujāla* of the toes, ankle, thorax, abdomen and throat produces convulsions and makes the body of the person bent inwards like bow then it is called *Abhyantarāyām*. It is one of the types of Dhanustambha.[15] According to *āchārya Charaka*, when vitiated *vāta* get located in snayu, it leads to production of *bāhyāyām, abhyantarāyām, khallī, kubja, sarvāngavāta or ekāngavāta* etc. All of these are *vātavyādhi*.[16]

Twaka

The word '*Twacha*' is derived Sanskrit root ‘sanvarane’ meaning which covers the body. Skin is a structure that covers the whole body, the seat of *sparshanendriya*, the location of the *Swedavaha Srotas*, as well as the place of *Roma* and *Romakupa*. *Twacha* is the seat of *sparshanendriya.* It is responsible for perception of touch. It covers the body externally.

It is the *Upadhatu* of *mamsa dhatu* according to *acharya Sushruta*, the union of *Shukra Shonita* while being cooked rise to formation of seven layers of *Twacha*; just e formation of cream at the time of boiling of milk.[17] Though *Twacha* is Panchabhautika, it has predominant *Vayu Mahabhuta.* clinical importance-*Twak* is the principal site of manifestation of many Ayurvedic diseases and serves as an important indicator of internal *Dosha* and *Dhatu* imbalance. Major skin disorders are described under *Kushta*, involving vitiation of *Tridosha, Twak, Rakta, Mamsa, and Lasika*, while *Visarpa* presents as rapidly spreading

inflammatory lesions. Twak is also affected in various *Kshudra Rogas* such as *Yauvana Pidika* (acne), *Vyanga* (melasma), *Nilika*, and *Tilakalaka*.

Raktavahi Dhamani

Dhamani denotes pulsatile vascular conduits characterized by rhythmic expansion and recoil generated by hemodynamic propulsion. The term is derived from *dhaman* (pulsation), reflecting their intrinsic pulsatory nature. Functionally, *Dhamanīs* facilitate the forceful centrifugal distribution of *Rasa* and subsequent *Dhatus* throughout the body, analogous to the arterial system in contemporary anatomy. Classical descriptions in the *Ashtanga Hridaya* portray *Dhamanīs* as deep-seated, tubular, unctuous, reddish channels transporting purified blood, closely corresponding to the morphological and physiological attributes of arteries. Furthermore, according to *Acharya Sharangadhara*, the *Rasavāhī Dhamanīs* serve as dynamic conduits for the transmission of *Vata*, emphasizing their role in systemic transport and circulatory regulation.[18] Clinical importance-*Dhamanigata Roga* results from the vitiation of *Doshas* affecting the *Dhamani*. It disrupts the normal flow of Rasa and Rakta, leading to impaired tissue nourishment and various systemic disorders.

Viddha lakshan-Swelling, emaciation (wasting of muscles), tumours of vein and death manifest.[19]

Dushti lakshan-Diseases caused by vitiated *Mamsa dhatu* like *adhimāmsa, Arbuda, kila, galashundika, Putimamsa, alaji, ganda, gandamāla, upjīvhikā* etc. can be seen.[20]

MODERN REVIEW

Muscle Tissue and Supporting Structures

Skeletal muscle: Location: Attached to the skeletal framework and located deep to the hypodermis. **Structure:** Composed of long, multinucleated skeletal muscle fibres supported by connective tissue sheaths (epimysium, perimysium, and endomysium) and supplied by blood vessels and nerves. The hypodermis contains areolar and adipose tissue providing cushioning and passage for neurovascular structures. **Functions:** Responsible for voluntary movement, posture, skeletal stabilization, and force generation. **Development:** Skeletal muscles develop from paraxial mesoderm through somites and myotomes. Myoblasts fuse to form multinucleated myotubes, which mature into striated skeletal muscle fibres. Mature fibres are long, cylindrical, multinucleated, striated, and voluntary.

Smooth Muscle: Location: Present in the walls of hollow organs such as blood vessels,

airways, gastrointestinal tract, and in the skin attached to hair follicles. **Structure:** Composed of non-striated, spindle-shaped, uninucleate muscle fibres. **Functions:** Produces involuntary movements such as propulsion of food and regulation of vessel and airway diameter; some smooth muscles show auto rhythmicity. **Regulation:** Controlled by the autonomic nervous system and hormones. **Development:** Smooth muscle develops mainly from splanchnic mesoderm or local mesenchyme. Mesenchymal cells differentiate into smooth muscle fibres containing actin and myosin filaments without cross-striations.

Cardiac Muscle Pericardium: Location: Surrounds the heart within the thoracic cavity. **Structure**: Composed of fibrous and serous pericardium enclosing a fluid-filled pericardial cavity. **Functions**: Protects and anchors the heart, prevents overstretching, and reduces friction during cardiac movements. **Heart Wall Layers Structure:** Consists of epicardium, myocardium, and endocardium. Epicardium: Protective outer layer with mesothelium and connective tissue. Myocardium: Thick muscular layer responsible for cardiac contraction. Endocardium: Inner endothelial lining providing a smooth blood-flow surface.[21] **Development:** Cardiac muscle develops from the splanchnic layer of lateral plate mesoderm. Cardiac myoblasts differentiate, branch, and form striated cardiac fibres with intercalated discs for synchronized contraction. Cardiac muscle is involuntary, branched, striated, and mostly uninucleate.

Ligament and tendons

Ligament Location: Connect adjacent bones around joints and reinforce the articular framework. **Structure:** Dense regular connective tissue composed mainly of parallel type I collagen fibres, fibroblasts, and few elastic fibres; poorly vascularized with proprioceptive nerve supply. **Types:** Capsular, extracapsular, and intracapsular ligaments. **Functions:** Stabilize joints, maintain alignment, guide movement, restrict excessive motion, and resist tensile stress.[22]

Tendons: Location: Connect skeletal muscles to bones at the terminal regions of muscles. **Structure:** Dense collagenous connective tissue composed of parallel type I collagen fibres and tenocytes; some are surrounded by synovial sheaths to reduce friction. **Types:** Cord-like tendons and flattened aponeuroses. **Functions:** Transmit muscular force to bones, facilitate movement, maintain posture, stabilize joints, and store elastic energy. **Development:** Ligaments and tendons develop from mesodermal mesenchyme during embryogenesis. Mesenchymal cells differentiate into fibroblasts and tenoblasts that produce collagen-rich

extracellular matrix. Tendons develop with skeletal muscles for muscle-to-bone attachment, whereas ligaments develop around joints for stability. In the trunk they arise mainly from paraxial mesoderm, and in the limbs from lateral plate mesoderm.[23]

Skin: Location: Forms the outer protective covering of the body, superficial to fascia and muscles. **Structure:** Consists of three layers epidermis (keratinized stratified squamous epithelium), dermis (vascular connective tissue with glands, vessels, nerves, and hair follicles), and hypodermis (areolar and adipose tissue). **Types:** Thin skin and thick skin; thick skin contains an additional stratum lucidum. **Functions:** Provides protection, sensation, thermoregulation, excretion, vitamin D synthesis, fat storage, and cushioning. **Development:** The epidermis develops from surface ectoderm, while the dermis and hypodermis arise from mesodermal mesenchyme. Skin appendages such as hair follicles, glands, nails, and mammary glands are ectodermal derivatives.[24]

Blood Vessels and Arteries: Location: Distributed throughout the body as a closed circulatory network connecting the heart with tissues and organs. **Structure:** Blood vessels consist of tunica intima, tunica media, and tunica adventitia. Arteries have thick muscular walls, elastic laminae, narrow lumen, and no valves. **Types:** Blood vessels include arteries, capillaries, and veins. Arteries are classified into elastic arteries, muscular arteries, and arterioles. **Functions:** Transport blood, gases, nutrients, hormones, and waste products; maintain circulation and blood pressure; regulate vasoconstriction and tissue perfusion. **Development:** Blood vessels arise from mesoderm. Angioblasts form endothelial tubes through vasculogenesis and angiogenesis, while surrounding mesenchyme forms connective tissue, smooth muscle, and elastic fibres. Arteries develop a thick tunica media for high-pressure blood flow.[25]

DISCUSSION

Mamsavaha Srotas are the channels responsible for the formation, nourishment, transport and maintenance of *Mamsa Dhatu* in the body. As per Ayurveda, *Mamsa Dhatu* is formed from *Rakta Dhatu* through the action of *Maṃsagni* and is responsible for structural support, body stability, movement and nourishment of *Meda Dhatu*. Functionally, *Mamsavaha Srotas* maintain the integrity and coordinated activity of muscular tissue. From modern perspective, this may be correlates with the musculoskeletal and neurovascular systems, which collectively maintain posture, locomotion, structural stability and tissue nourishment of body. From developmental, anatomical, and physiological perspectives, the skin, connective tissues,

nerves, blood vessels, and skeletal, cardiac and smooth muscles collectively form a unified Musculo-neurovascular system comparable to *Mamsavaha Srotas*.

Mulastana of Mamsavaha Srotas

According to Acharya Sushruta, *Snayu*, *Twak*, and *Raktavahi Dhamani* constitute the *Mulastana* of *Mamsavaha Srotas*, collectively representing the structural, protective, vascular, and regulatory apparatus essential for muscular integrity and function.

Snayu correspond to dense collagenous connective tissues including tendons, ligaments, fasciae, and aponeuroses which provide biomechanical stability, facilitate force transmission, and maintain musculoskeletal architecture. Physiologically, they integrate muscular contraction with skeletal movement and joint stabilization. Embryologically, these structures originate from mesoderm-derived mesenchyme and develop synchronously with myogenic precursors, forming the supportive stromal framework of skeletal musculature.

Twaka represents the integumentary complex encompassing the epidermis, dermis, and subcutaneous tissue. Beyond its protective role, it contributes to sensory transduction, thermoregulation, immunological surveillance, and metabolic homeostasis, thereby maintaining an optimal microenvironment for underlying muscular tissues. Developmentally, the epidermis arises from ectoderm, whereas the dermis and hypodermal connective tissues are mesodermal derivatives, reflecting coordinated morphogenesis between the integument and musculoskeletal systems.

Raktavahi Dhamani are specialized pulsatile vascular conduits analogous to the arterial network, responsible for the delivery of oxygen, nutrients, hormones, and regulatory molecules indispensable for muscular metabolism, growth, repair, and contractile activity. Their physiological role extends to maintaining tissue perfusion, hemodynamic regulation, and metabolic exchange. Embryologically, they arise from mesodermal angioblasts through vasculogenesis and angiogenesis, followed by differentiation of vascular smooth muscle and connective tissue components from surrounding mesenchyme. Thus, from anatomical, physiological, and embryological perspectives, the *Mulastana* of *Mamsavaha Srotas* can be interpreted as an integrated Musculo-connective-vascular system that ensures the development, nourishment, protection, and functional coordination of muscular tissue.

CONCLUSION

Mamsavaha Srotas may be interpreted as an integrated Musculo-neurovascular continuum governing myogenesis, tissue trophism, biomechanical stability, and locomotor function. Its *Mulastana Snayu*, *Twaka*, and *Raktavahi Dhamani* correspond to the connective tissue, integumentary, and vascular compartments, which exhibit coordinated mesodermal ontogeny and functional interdependence. This structural and developmental concordance substantiates the Ayurvedic concept of *Mamsavaha Srotas* within the framework of contemporary anatomical and developmental biology.

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