ANATOMICAL STUDY OF SHLESHMDHARA KALA WSR SHOULDER JOINT

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ABSTRACT

Anatomy is the science that deals with study of the different structures of human body. Kala Sharir is one of the important concepts of Ayurveda anatomy which is mainly about the layers or membranes of the body. Kala is the term stated by Acharya Sushruta in relevance of sheath or beholding membrane of internal organs. Among the Sapta Kalas, Shleshmadhara Kala is fourth important Kala which is described by Acharaya Sushruta and other Acharyas. It is present specially in all the Sandhi. It could be correlate with the Synovial membrane of the joint as per modern Anatomy. Aim of this study is to determine the applied aspect of Shleshmadhara Kala. Objectives of this study are to compare the anatomical structure of Shleshmadhara Kala according modern anatomy and to evaluate the Doshic involvement in various ailments like Osteoarthritis, Rheumatoid arthritis and gout etc. in Shleshmadhara Kala. To fulfill such aim and objectives we have reviewed all the Ayurvedic classics, related literature and modern anatomy literature. Key words: Shleshmadhara Kala, Synovial membrane, Sushrutachrya, Kala Sharir.

INTRODUCTION

Kala Sharir is one of the important aspects of Ayurvedic Sharir Rachna Vijnyana which mainly deals with the layers and membranes which covers various organs and tissues of the body. Kala is the term stated in Ayurveda for various purposes including unit of time and membrane etc., with respect to anatomical view it can be correlated with membranous structure. Kala is a unique concept explained by Acharaya Sushruta in "Garbhavyakarana Sharir Adhyaya." Sushrutachrya defined the Kala as separator between Dhatu (tissues) & its Ashaya (organ or viscera), here Ashaya described as cavity that holds Dhatus. [1] During foetal development, Kleda or moisture present in between the Dhatu and its Ashaya, reacting to its own heat gets converted into Kala. [2] Kala Swaroop (structure) described by Acharaya are the body parts covered by Snayus, enveloped Jarayu and smeared with Kapha. [3] As per modern science it can be correlated with mucous membranes and epithelium. Therefore, Kala is membrane which protected by Snayus and secrets mucous; thus, Snayu and Shleshma are considered as components of Kala. The first Kala is known as Mamsadhara, the second is Raktadhara, the third is Medodhara Kala, the fourth is Shleshmadhara Kala, the fifth is Purishdhara Kala, the sixth is Pittadhara Kala and the seventh is Shukradhara Kala, thus the seven Kala. [4] A basic structure of Sandhi is described as union of Asthi (bony surfaces), presence of Shleshmadhara Kala (synovial membrane) and Shleshak Kapha (synovial fluid). Joint diseases as mentioned in modern science can be classified in to inflammatory or noninflammatory (degenerative) diseases. According to Ayurveda diseases have to be justified as Sama or Nirama condition. Here an attempt is made to understand involvement of different Doshas in these inflammatory and non- inflammatory joint diseases in respect of Shleshmadhara Kala, it will evaluate the different Sandhigat Vyadhi, by compiling the existing evidences.

AIM AND OBJECTIVE

Aim of this study is to determine the applied aspect of Shleshmadhara Kala. Objectives of this study are to compare the anatomical structure of Shleshmadhara membrane with the Shoulder joint movement according modern anatomy and to evaluate the Doshic involvement in various ailments like OA, RA and gout etc. with respect to Shleshmadhara Kala.

MATERIALS AND METHODS

From various classical texts Bruhatrayi like Charaka Samhita, Sushruta Samhita, Ashtanga Samgraha, Ashtanga Hrudaya and Laghutrayi like Madhav Nidan, Sharangadhara Samhita etc and evidence based resources as scientific journals, books and data based information from various texts.

DISCUSSION

The body parts covered by **Snāyu** (ligaments and tendons), enveloped by Jarāyu (membranous covering), and nourished by Kapha are described as Kalā in Ayurveda. In modern science, these structures can be correlated with mucous membranes and epithelial linings**.** The Kalā acts as an interface between the Dhātu and its Āśaya (organ cavity), separating the hollow lumen of an organ from its surrounding tissues. Thus, the mucosal lining of hollow organs may be considered a representation of Kalā.

Among the seven types of Kalās, the Śleṣmādhārā Kalā is the layer that retains and secretes mucous, present in all synovial joints. It has been compared in Ayurvedic texts to oil within the axle of a wheel, enabling smooth and frictionless movement of joints. The Śleṣma (synovial secretion) produced by this Kalā facilitates free mobility of the articular surfaces on their respective axes.

In modern anatomy, this function corresponds to the synovial membrane, a specialized connective tissue lining the inner surface of synovial joint capsules and tendon sheaths. The term **synovium** refers to this soft tissue, which secretes synovial fluid—a lubricating and nourishing medium for joints.

Ayurvedic classics describe the basic structure of Sandhi (joint) as consisting of Asthi (articular bone ends), Śleṣmādhārā Kalā (synovial membrane), and Śleṣaka Kapha (synovial fluid). Suśruta does not elaborate the detailed structure but emphasizes this triad. In modern science, the synovial joint is structurally composed of a synovial cavity, articular cartilage, fibrous capsule, synovial membrane, and supporting ligaments**.**

Ayurveda classifies joints into Chala (movable) and Achala (immovable) types. Suśruta further identifies eight varieties of joints—Kora, Udukhal, Samudga, Tunnasevani, Vayastunda, Maṇḍala, Śaṅkhavarta, etc.—based on morphology. In contrast, modern anatomy classifies joints into fibrous, cartilaginous, and synovial types, depending on the tissue composition and the presence or absence of a cavity.

Both Ayurveda and modern science recognize inflammatory and degenerative disorders of joints. Ayurveda mentions conditions such as Sandhigata Vāta, Asthi-Majjāgata Vāta, Āmavāta, Vātarakta, Abhyantara Phiranga, Kroshtukśīrṣa, and Vātakaṇṭaka. Among these, the first five affect multiple joints, while the latter two predominantly involve the knee and ankle respectively. Modern medicine similarly categorizes joint disorders into inflammatory diseases (e.g., rheumatoid arthritis, bursitis, infective arthritis) and non-inflammatory/degenerative diseases (e.g., osteoarthritis, traumatic arthritis, congenital anomalies).

Acharya Charaka describes the cardinal features of Sandhigata Vāta **as** painful joint movements, inflammation, and tenderness, which closely resemble osteoarthritis, where degeneration of the synovial membrane and cartilage leads to stiffness and pain. Asthi-Majjāgata Vāta presents with persistent pain in small joints and bones, paralleling conditions such as avascular necrosis (AVN)**.** Āmavāta, characterized by Sandhiśūla (joint pain), Sandhiśotha (swelling), stiffness, and migratory pain, corresponds to rheumatoid arthritis**,** where pannus formation and progressive destruction of cartilage and bone lead to

deformity. Vātarakta, when superficial, manifests as Uttāna Vātarakta resembling gout; in its deeper manifestation (Gambhīra Vātarakta**),** features such as swelling, stiffness, deformity, and ulcerations resemble psoriatic arthritis**.**

Thus, comparison shows that joint pain (Sandhiśūla) and joint swelling (Sandhiśotha) are common denominators in almost all joint disorders. However, Ayurveda notes a distinctive feature of crepitus (Aṭopa) in Sandhigata Vāta, which directly correlates with the classical sign of osteoarthritis.

CONCLUSION

The **Śleṣmādhārā Kalā**, identified by Ācārya Suśruta as the sixth Kalā present in the **Sandhis** (joints), plays a crucial role in maintaining joint health. In the **shoulder joint (Aṃsa Sandhi)**, the most mobile synovial joint in the human body, this Kalā acts as the substratum for **Śleṣaka Kapha**, ensuring lubrication, nourishment, and stability during complex movements. From an anatomical perspective, **Śleṣmādhārā Kalā** can be correlated with the **synovial membrane**, while **Śleṣaka Kapha** corresponds to **synovial fluid**. Together, they protect articular surfaces, reduce friction, and support the extensive range of motion characteristic of the shoulder joint.

This study demonstrates that the Ayurvedic concept of **Śleṣmādhārā Kalā** aligns closely with modern anatomical understanding of synovial structures, emphasizing the scientific basis of classical knowledge. Dysfunction of this Kalā is associated with conditions such as **Sandhigata Vāta** and **Āmavāta**, which correspond to degenerative and inflammatory disorders affecting the shoulder joint.

The **shoulder** is a ball-and-socket joint that enables the arm to move through an exceptionally wide range of positions during daily activities. The **ball** is formed by the **head of the humerus**, while the **socket** is formed by the **scapula**, also known as the **glenoid cavity**. Both the humeral head and glenoid surfaces are covered with **cartilage**, a specialized tissue that allows smooth, frictionless movement of the joint (Powell et al., 1999). The **glenohumeral joint** serves as the primary articulation of the shoulder.The **shoulder** is a multiaxial, ball-and-socket synovial joint formed by the articulation between the **humeral head** and the **glenoid fossa** of the scapula. Among all joints in the body, the shoulder complex exhibits the greatest mobility. It is described as comprising five articulations: **glenohumeral (GH), acromioclavicular (AC), sternoclavicular (SC), scapulothoracic (ST),** and **subdeltoid joints**. Of these, the scapulothoracic and subdeltoid articulations are considered "false joints," as they involve movement between two musculotendinous surfaces rather than true bony articulations (Jobe et al., 1998).

The mechanics of the shoulder are highly complex, allowing it to perform numerous functional tasks. Its extensive **range of motion** is necessary for the hand, the body's primary executive organ. However, this mobility also makes the glenohumeral joint susceptible to **arthritic and degenerative disorders**, which are major causes of joint-related morbidity.

Similarly, complex fractures of the proximal humerus present a challenge because achieving and maintaining accurate reduction and fixation is difficult (Edwards, 2001).

Shoulder arthroplasty aims to restore comfort and function to the glenohumeral joint. Successful outcomes depend on four key mechanical characteristics: **motion, stability, strength,** and **smoothness**. A comprehensive assessment of a patient's overall health and quality of life is essential for predicting treatment outcomes. Over the years, shoulder arthroplasty has become a rapidly expanding orthopedic reconstructive procedure, delivering

favorable results. The role of **prosthetic replacement** has grown alongside improved understanding of shoulder anatomy and reconstructive techniques. Current practice typically involves the use of a **humeral head prosthesis** for fresh fractures or degenerative arthritis in which the glenoid remains relatively intact.

for the more severe cuff tear deficits where satisfactory cuff function is not anticipated (Smith et al, 1998).In order to reduce pain and improve overall upper extremity function, **humeral head replacement alone** may not always be sufficient to address the various issues associated with **glenohumeral arthritis**. **Total shoulder replacement** is recommended for advanced cases where the rotator cuff can be reconstructed and bone deficits can be restored (Gartsman et al., 2000). Both **hemiarthroplasty** and **total joint arthroplasty** have demonstrated excellent outcomes, with over 90% of patients reporting significant pain relief, improved range of motion, and enhanced functional ability. Furthermore, the rate of complications following shoulder arthroplasty is lower than that observed in other major joint reconstructions.

Several types of **shoulder arthroplasty** are available:

1. **Hemiarthroplasty**
2. **Total joint replacement**, which can be:
   a. Unconstrained
   b. Semiconstrained
   c. Constrained
3. **Bipolar shoulder arthroplasty**
4. **Resurfacing shoulder arthroplasty**
5. **Reverse total shoulder arthroplasty**

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