Section A-Research paper

Exploring Traumatological Anatomy of *Gulpha Sanghat*: A Review

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ABSTRACT

Gulpha as a *sandhi* (joint) situated in bilateral lower limbs along the junction of the *paada* (foot) and *jangha* (legs) whereas *Sanghat* explained as union of two or more *Asthi* joins together with help of surrounding structures such as *mamsa*, *sira*, *snayu* and *kandra* which hold strongly and provides more stablity to *Sanghat. Acharya Sushruta*, considered *Gulpha* as *Rujakar Marma* which means those areas of the body where pain persist even after the best management of trauma. In modern era due to fast life style changes and increased road side injuries which cause over use of the *Sanghat* thus leads to trauma. The talocrural / ankle joint is a very stable joint but when subjected to distraction and compression, gets injured which leads to different conditions such as sprain, fractures etc. Sprains are termed as injury to the ligaments and ankle joint is a type of joint which mainly depends on the ligaments for stability. The ligaments of the lateral side of the ankle are weaker and prone to injuries leading to rupture of the ligaments. Injuries around the ankle joint cause functional deformities. Hence, this study was planned to review and explore the hidden complexity which was described by *Acharya's* for better understanding the anatomy of *Gulpha Sanghat* and providing a better solution to the management of trauma

KEYWORD: *Gulpha sanghat sandhi*, *Gulpha marma*, Ankle joint, Talocrural joint, Trauma

INTRODUCTION

The main aim of *Ayurveda* is to maintain and preserve health. The human body consist of multifaceted system of different type of tissue, ligament, tendons, muscle, organ, etc. each component and system play a major role in function of human body. *Gulpha* as a *sandhi* (joint) situated in bilateral lower limbs along the junction of the *paada* (foot) and *jangha* (legs) whereas *Sanghat* explained as union of two or more *Asthi* joins together with help of surrounding structures such as *mamsa*, *sira*, *snayu* and *kandra* which hold strongly and provides more stablity to *Sanghat. Acharya Sushruta* explains *Sandhi* and *Sanghat* in one chapter but giving different identities to them. The idea behind giving the different identity is the complexity of the *Sanghat*. *Gulpha Sanghat* is one of the fourteen *Sanghat* mentioned by *Acharya Sushruta*, considered *Gulpha* as *Rujakar Marma* which means those areas of the body where pain persist even after the best management of trauma.

In modern era due to fast life style changes and increased road side injuries which cause over use of the *Sanghat* thus leads to trauma. Hence, this study was planned to review and explore the hidden complexity which was described by *Acharya's* for better understanding the anatomy of *Gulpha Sanghat* and providing a better solution to the management of trauma.

AIMS AND OBJECTIVES

To review and explore the hidden complexity which was described by *Acharya's* for better understanding the anatomy of *Gulpha Sanghat* and providing a better solution to the management of trauma.

MATERIALS AND METHODS

To fulfil the aims and objectives relevant Ayurvedic texts such as *Brihtrayi*, *Laghutrayi* and other classical text including Dictionaries, Literature of the contemporary science, as well as the data bases Google scholar, PubMed, Medline, AYUSH Research Portal, and Digital Helpline for Ayurveda Research Articles (DHARA), dissertation works from Ayurveda colleges, studies available on Research Gate web-based search engines, journal, were used to searched and presented in systematic manner.

REVIEW OF LITERATURE

Ayurveda concept about Anatomical aspect of *Gulpha*

GULPHA

Etymologically the word *Gulpha* has been derived from the Sanskrit root "*Gal*". So the derivation of the word *Gulpha* is from "*Gal*" *dhatu* (root), "fuk" prateya (affix)[1]. Synonyms are *Gulpha, Khulaka, Khudaka, Khallaka, kuduka*[2]*, Charna granthi, Pada granthi*[3].

Different *Acharya's* in *Ayurvedic* literature describe or define *Gulpha* as a *sandhi* (joint) situated in bilateral lower limbs along the junction of the *paada* (foot) and *jangha* (legs)[4]. *Sushruta* mentioned as the union of *Jangha, Charna* is termed as *Gulpha* and also known as *Gulpha Marma*[5]. The joint between the *Jangha* and *Charna* as *Gulpha* elucidated by *Acharya Indu*[6].

SANGHAT

The word Sanghat derived from "*han*" *dhatu* with "*sam*" *upasarga* and "*gaj*" *pratyaya* which means *Sanghat*[7]. In *parishad Shabdartham* while explaining *Asthi Sanghat Acharya Ghanekar* said that *Sanghat* can be taken as special form of *Sandhi*[8]. *Sanghat* explained as union of two or more articular surfaces of bone with surrounding structures i.e *mamasa*, *snayu* and *kandra* which take part in *Sanghat* formation and provide more stability to *Sanghat* and is nothing but a special form of *Sandhi* with more complex structures present in it. Hence, *Sandhi* and *Sanghat* both are synonyms[9].

SANDHI

The word *Sandhi* belongs to pullinga. "*Sam*" *upsarga* has been used. It is originated by: "*Dha*" *dhatu* "*Ki*" *pratyaya* is used. This means *Sandhanamiti*- Holding together, joining and binding[10]. Synonyms are *Sandhi, Slesha, Anekartha Sangraha- Sanyoga*[11].

Sandhi defines as where two or more articular surfaces of bone are joined together[12]. Bones plays vital role in the *Dharan Karma* of *sharir* and bones are joined to each other with the help of *Mamsa*. *Sira, Snayu* and *Asthi* binding each other are collectively can be considered as *Sandhi*[13]. *Gulpha Sandhi* is one of the most important *Sandhi* of the lower extremities mainly associated with locomotion and weight bearing *Sandhi*. Structurally it is classified under *Kora Sandhi* and functionally it is a *Bahuchala Sandhi*.

GULPHA MARMA

Acharya Sushruta explained *Gulpha Marma* situated on the junction of the *Jangha* and *Pada*[14], in both lower extremities. In *Astangha samgraha, Gulpha Marma* as the joint between *Pada* and *Jangha*. *Jangha* is the leg and the *Charana* indicate the foot. The meaning of word *Jangha*

is leg between knee and the ankle. Regionally *Gulpha Marma* is a *Shaka Marma*, dimensionally 2 *Anguli Praman* and two in number. Based upon the anatomical classification, included in *Sandhi Marma*. Prognostically, *Gulpha Marma* grouped under *Rujakar Marma* in which *Agni*, *Soma* and *Vayu Mahabhuta* are predominant. Any injury to *Gulpha Marma*, person feel as if full of thorns, even after healing there is shortening of the limb, lameness, decrease in strength, restriction of the movements, and atrophy of muscle and swelling of the joint[15].

Acharya Susrutha explained *Vata* aggravates as a result of *Marmabighata* and produce severe pain[16]. *Dosha* stay in between *twak*, *mamsa* and *snayu* in *Sopha* [17]. On injury to bones, muscles, blood vessels and joints do not inflict the person so as the ligament [18]. Shortening and debility of body parts, pain and delayed wound healing are the consequences of injury to the *Snayu* [19]. The symptoms of *Gulpha Sanghat Abhighata* can be compared with that of fractures associated with ankle joint e.g., Pott's fracture, Maisonneuve's fracture.

The concept of *Rujakar Marma* is based on the patho-physiology of the trauma and are eight in numbers[20]. Injury to *Rujakar Marma*, if not treated wisely and are managed by unskilled person then lead to one or the other form of deformity and end with morbidity, in turn to *Vaikalyakara* post traumatically with the passage of time. So, very important and essential to know the anatomy of the *Rujakar Marma* for the successful line of management of trauma[21].

Modern concept about Anatomical aspect of Talocrural / Ankle joint

The talocrural / ankle joint is of uniaxial type, present in both lower extremities and is formed by the tibia and its malleolus of the fibula with upper end of the Talus, is a kind of compound Synovial (Hinge) joint. The articular capsule of ankle joint anteriorly and posteriorly is weak but mainly supported by strong medial and lateral ligaments on medial and lateral side respectively. The medial collateral ligament also called as the deltoid ligament which is divided into three parts- the anterior fibres - Tibionavicular ligament, middle fibres - Tibiocalcaean ligament and posterior fibres - Tibiotalar ligament. Tibilotalar ligament further divided into posterior and anterior part. Lateral collateral ligament also divided into three parts- anterior talofibular ligament, posterior talofibular ligament and calcaneofibular ligament. Tibialis anterior, Extensor hallucis longus, Anterior tibial vessels, Deep peroneal nerve, Extensor digitorum longus and Peroneus tertius are have anteriorly relations of ankle joint from medial to lateral . Tibialis posterior, Flexor digitorum longus, posterior tibial vessels, tibial nerve and flexor hallucis longus are posterior relations from medial to lateral. The Deltoid ligament,

Tibial posterior and Flexor digitorum longus. Lateral to the joint are calcaneofibular ligament (part of lateral collateral ligament), Peroneus longus and Peroneus Brevis are medial to the joint. . The muscle act on the ankle through three separate compartments such as anterior compartment muscles cross the ankle joint anteriorly to act as a dorsi-flexors. The muscles of the posterior and lateral compartments cross the ankle joint, posteriorly to form plantar flexors. Blood supply of ankle joint are from malleolar branches of the anterior and posterior tibial and the peroneal arteries. Ends of muscles are attached to bone, cartilage or ligaments by a cord of fibrous tissue called tendon. Blood supply of foot comes from three primary source arteries i.e. peroneal artery, posterior tibial artery and anterior tibial artery. The dorsal venous arch drains into the greater and lesser saphenous venous system. The sciatic nerve divides into the common peroneal and posterial tibial nerve. The movements of ankle joint are Dorsi-flexion and Plantar-flexion (Fig.1, 2, 3, 4, 5, 6)[22, 23, 24].

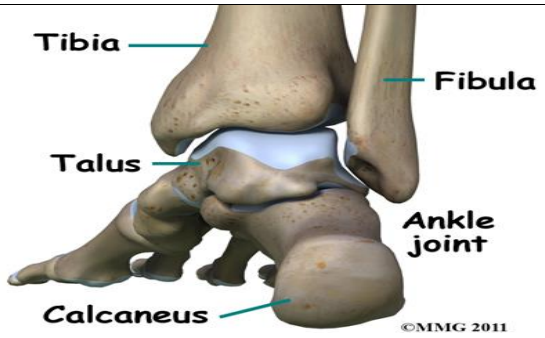

Fig.1: Posterior View of Ankle joint.

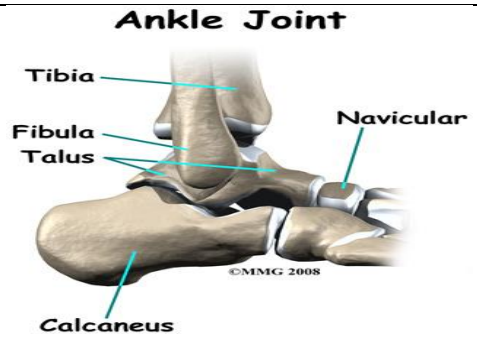

Fig.2: Lateral View of Ankle joint.

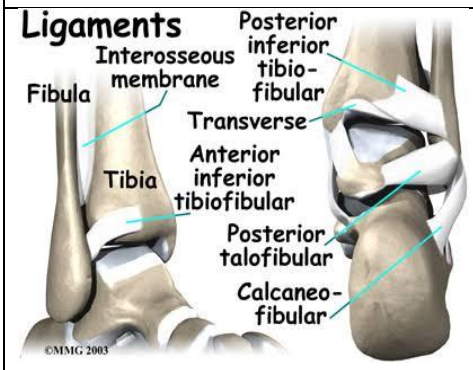

Fig.3: Medial or Deltoid Ligaments

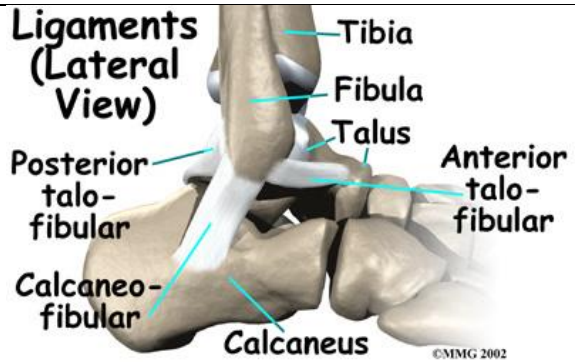

Fig.4: Lateral Ligaments

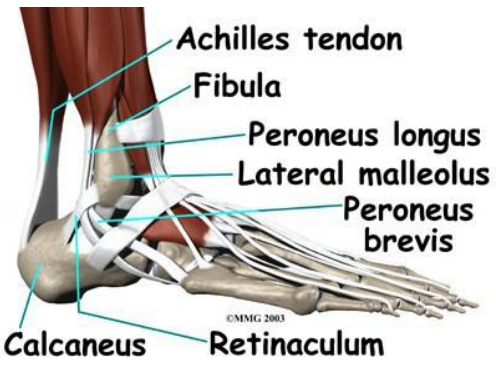

Fig.5: Tendons of the Muscles at Ankle joint

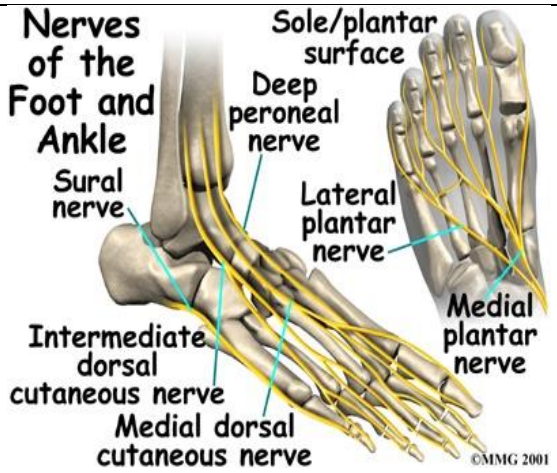

Fig.6: Nerve Supply of Ankle Joint

Gulpha Sanghat can be compared anatomically with the flexor and extensor tendons. Injuries to the structures produce similar symptoms, which are associated with the stability of the joint. The anatomical position of *Gulpha Sanghat* is closely associated with that of the lateral and medial collateral ligaments. Medially deltoid ligament and laterally the lateral ligament complex especially the anterior talofibular ligament can be compared to the *Gulpha Sanghat*. The symptoms of ankle sprain, various local fractures and *Gulpha Sanghat Abhighata* are closely correlated to each other. Both will produce pain and swelling as symptoms on injury. This cements the comparison between *Gulpha Sanghat* and medial-lateral collateral ligaments.

The ankle joints and surgical condition is due to chronic inflammation of capsular and extra capsular tissue. The injury of ankle joint can be studied under three headings namely tendon, ligaments and bones[25]. Abnormal or excessive forces produce injury to the bones and ligaments, usually by indirect violence. A combination of the force may produce a variety of fractures, dislocation and stress. The malleoli are attached to the talus by the joint capsule and collateral ligament, the fragments follow the displacement on the foot of the leg bones. The trauma and its management rounds the tissue injury and its response. However the microanatomy of the structure changed affecting the physiology of the tissue but not amounting to the functional observation and understanding of the mechanism of the fracture and the anatomy involved are essential for intelligent in management of injury.

DISCUSSION

Gulpha Sandhi is important *Sandhi* of lower limb, responsible for the various movements of the body such as standing, running and climbing etc. *Gulpha* is situated at the junction of foot

and leg. Anatomically, it is a *kora* variety and *Bahuchala*. In the contemporary science, *Gulpha Sandhi* can be considered as ankle joint complex.

Ruja is a sensation of pain felt by mind and body together. *Ruja* is the first sign of morbidity of any tissue .Injury or trauma to soft tissue structures including skin, fascia, tendons, ligaments and the periosteum all can provoke nociceptive pain responses. Any trauma to *Gulpha Marma* also causes severe *Ruja*. In *Shabadkalpadruma*, it has been mentioned as "*Stambha iha Kriyanirodhaha*" means functional disability and any injury to the ankle joint can cause inflammation of capsule and extra capsular tissue. Involvement of nerves and ligaments can cause restriction of motion of ankle joint which is similar to *Stambha* which is mentioned in *Gulpha Marma Vidha Lakshan*. *Khanjata* means limping or lameness. Ankle injuries can damage the tendons of the muscles such as flexor halucis longus etc. Lateral ligament and produce lameness which can be well correlated with the *Khanjatha* mentioned in the *Ayurvedic* literature. The symptoms of *Gulpha Sanghat Abhighata* can be compared with that of fractures associated with ankle joint e.g., Pott's fracture, Maisonneuve's fracture.

Ankle joint is a very stable joint but when subjected to distraction and compression, it gets injured. It depends on the type of stress and severity of the force which leads to different conditions such as sprain, fractures etc. Sprains are termed as injury to the ligaments and ankle joint is a type of joint which mainly depends on the ligaments for stability. The ligaments of the lateral side of the ankle are weaker and prone to injuries leading to rupture of the ligaments. Injuries around the ankle joint cause functional deformities.

Gulpha Sanghat can be compared anatomically with the flexor and extensor tendons. The anatomical position of *Gulpha Sanghat* is closely associated with that of the lateral and medial collateral ligaments. The symptoms of ankle sprain, various local fractures and *Gulpha Sanghat Abhighata* are closely correlated to each other. Injuries to the structures produce similar symptoms, which are associated with the stability of the joint. Both will produce pain and swelling as symptoms on injury. This cements the comparison between *Gulpha Sanghat* and medial-lateral collateral ligaments.

Trauma and its management, rounds around the tissue injury, and its response. Whenever the physiology and anatomy of any tissue tend to be altered it resist and reacts as per law of inertia i.e. any substance resist any alteration to its present status. Pain is the first sign of morbidity of any tissue. The phenomenon has already been observed due to lack of oxygen giving rise to

changes in the polarity. Hence, understanding of the mechanism of the fracture and the anatomy involved are essential for intelligent in management of injury.

CONCLUSION

Gulpha mainly located between pada and jangha. Ankle joint or the talocrural joint can be considered as the *Gulpha Sanghat.* Any injury or trauma to *Gulpha Marmabhigata* leads to *Ruja* and *Stambha,* further not treated leads to the disability of the joint i.e., *Vaikalyata.* The *Khanjata* means disability is due to the deformity of structures involved in the *Gulpha Sandhi Marma*. The ankle joint is vital and important part of body, which need to be protected from trauma or injury. Hence, can be concluded that understanding the anatomy are essential for intelligent in management of injury.

CONSENT

It is not applicable.

ETHICAL APPROVAL

It is not applicable.

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COMPETING INTEREST

Authors have declared that no competing interest exist.

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