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Critical review of *Ani Marma* of Upper limb with reference to Volkamann's Ischaemic Contracture

Dr. Shivanand Ganachari¹, Dr. Vishwanath²

¹Associate Professor, Department of Rachana Sharira, Government Ayurveda Medical College, Bangalore, Karnataka,

²Associate Professor, Department of Rachana Sharira, Government Ayurveda Medical College, Shimoga, Karnataka, INDIA.

ABSTRACT

Ayurvedic authorities in the form of *Samhitas* have given due importance to the knowledge of anatomy. *Acharya Sushruta* emphasized the importance of anatomical regions of the body, while treating the traumas occurring in war and established the knowledge of these vulnerable structures in *Sushruta Sharirasthana* 6th chapter as *Marma Sthanas*. The *Marmas* of the upper limb need much to care, as a little injury of it can lead to a permanent disability of the limb which can make one's life miserable. So, these are analysed scientifically and discussed emphatically to reveal the anatomical structures at that level. Symptoms and complications due to injuries of the *Marmas* are co-related with the injuries to the various structures present around it which is helpful in surgical approaches of the involved structure. In the present review, the symptoms formed due to injury to the *Ani Marma* of upper limb are presented as *Sthabdabahuta* i.e., functional deformity of the arm. These effects are correlated to a symptomatology referred as "Volkamann's Ischaemic Contracture" since the symptoms of both appears to be similar.

Key words: *Animarma, Sthabdabahuta, Shophabhivridi, Volkamann's Ischaemic Contracture.*

INTRODUCTION

Acharya Sushruta is entitled as the 'Father of Surgery'. *Sharira Sthana* of *Sushruta Samhitha* is an elaborative presentation of many anatomical entities and concepts. Ayurvedic experts of old time essentially served the royal staff managing the war injuries too during war times. *Sushruta*, being an expert in surgical faculty, utilized the opportunity and composed *Marma Sharira* which is a matchless presentation of

traumatological anatomy. The chapter on *Marma Sharira* display wide range of information regarding trauma on specific anatomical sites, its effects and its specific care.

Marmas, the vulnerable regions are said to be 107 in number distributed throughout the body. The value of *Marmas* in present time has not decreased in any way and it still holds the attraction of anatomists and surgeons in high amount. Probing into the details of anatomical and surgical values of various *Marmas* is always worthwhile and fruitful exercise. Every *Marma* holds significant scientific values where none can ignore this for the research purpose.

Marmas of the upper limb are placed in a much important area as each one of it belongs to the orthopaedic traumatology of upper limb in much of its consideration. Most injuries of upper limb need much to care because they frequently lead to the disabilities in the performance of professional and personal activities of a person. Even a little disability of upper limb can make a person jobless. Since injuries on the

Address for correspondence:

Dr. Shivanand Ganachari

Associate Professor, Department of Rachana Sharira, Government Ayurveda Medical College, Bangalore, Karnataka, INDIA.

E-mail: drshivanand79@gmail.com

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Marmas of the upper limb always a serious affair for the patient as well as the surgeon, anatomical and surgical study of it will be needful exercise in the subject of *Rachana Sharira*.

Sushruta has explained 11 *Marmas* in each limb making it 44 comprising all the four limbs as a whole. When we see the literature about detailed explanation of the *Marmas*, *Sushruta* has only referred the lower limb *Marmas* and accordingly upper limb *Marmas* can be considered except for joints of the limbs. As the present review is concerned, *Ani Marma* is situated near the distal end of both the arms in the upper limb and thigh in the lower limb.

Ani Marma

Janun urdhwamubhayatas trayangulamaani |

Tatra shophabhivridihi sthabdasakthita cha ||
(Su.Sha. 6/24)^[1]

According to the above verse, *Ani Marma* is situated 3 *Anguli* above the level of *Janu Sandhi* in the lower limb. Any injury to it results in the inflammation (*Shophabhivridi*) and stiffness of the thigh (*Stabdaskthita*) leading to the disability of the entire lower extremity.

Etenetara sakthi baahu cha vyaakhyatow |

Visheshatastu yaani sakthigulphajaanuvitapaani |

taani baahow manibandhakurparakakshadharaani ||
(Su.Sha. 6/24)^[2]

Sushruta has not explained the *Marmas* of the upper limb separately. The reader should consider *Manibandha*, *Kurpar* and *Kakshadhara* in place of *Gulpha*, *Jaanu* and *Vitapa* respectively explained for lower limb. In the same manner, *Ani Marma* for upper limb can be considered as, situated 3 *Anguli* above the level of *Kurpar Sandhi*. Any injury to it results in the inflammation and stiffness of the arm leading to the disability of the entire upper extremity. Even though the site and effect of *Ani Marma* are same in both upper and lower limbs, few symptoms differ according to the structures involved.

Classification of Ani on various basis

Type according to *Rachana* : *Snayu Marma*

Type according to *Shadanga* : *Shakhagata*

Type according to *Parinama* : *Vaikalyakara*

Type according to *Parimana* : *Ardha anguli*

Location of the Marma

According to *Acharya Sushruta*, *Ani Marma* is one of the eleven *Marmas* of the upper extremity. The *Marma* is located three fingers unit above the elbow joint. Anatomically, it is located in the distal part of the arm, proximal to the medial epicondyle of the humerus. The *Marma* is closely related to the structures i.e., brachial artery, biceps brachii tendon, coracobrachialis, median nerve and ulnar nerve.

Analysis of the Marma site

For analysing the *Marma* site, one should draw a horizontal line over the elbow crease by keeping the elbow slightly flexed. The muscles of the arm get stout in semi flexed state of the elbow joint. Then draw a perpendicular line upwards from the centre of the elbow crease. Mark a point three fingers breadth above the elbow crease on the perpendicular line. Here, finger breadth should be measured by using the patient's finger only. This point indicates the exact site of *Ani Marma*.

Structures involved

Brachial artery,

Supracondylar region of humerus,

Tendon of biceps brachii,

Tendon of Brachialis,

Median nerve

Musculocutaneous nerve

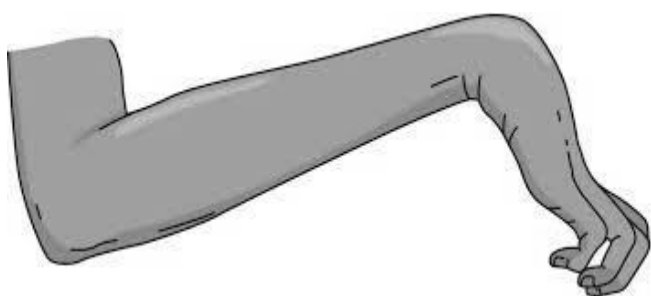
Effect after injury

By observing the above structures, it seems that the site is mainly having tendinous part of the biceps brachii and brachialis muscles and a terminal part of brachial artery. Biceps brachii and brachialis are the main flexors of the elbow. Any trauma of the insertion

tendon of these muscles restricts the movement of the forearm at elbow (*Sthabdabahuta*). The trauma on another major structure i.e., brachial artery can cause inflammation in the muscular compartment due to collection of blood outside the lumen of the artery (*Shophabhivridi*).

Volkmann's ischaemic contracture is a permanent flexion contracture of the upper limb at the wrist, resulting in a claw-like deformity of the hand and fingers. Passive extension of fingers is restricted and painful. It results from acute ischaemia and necrosis of the muscle fibres of the flexor group of muscles of the forearm, especially the flexor digitorum profundus and flexor pollicis longus.^[3] The muscles become fibrotic and shortened leading to the disability of entire upper limb. The person cannot use the limb for any professional or even his day-to-day activities.

Fig. 1: Volkmann's ischaemic contracture



Causative factors

Any fracture at the elbow or distal part of the arm may lead to Volkmann's ischemic contracture, but it is especially associated with supracondylar fracture of the humerus.^[4] A displaced supracondylar fracture of the humerus is the most commonly associated injury with Volkmann contracture of the forearm.^[5] The trauma or fracture causes the injury, spasm or obstruction of the brachial artery just above the elbow reducing the blood flow to the muscles of the forearm. It may also occur possibly from compartment syndrome, improper use of a tourniquet or a plaster cast at the distal end of the arm. Missed compartment syndrome can lead to Volkmann ischaemic contracture of the forearm which affects deep volar compartment most profoundly.^[6]

High blood flow in this region soon after the fracture leads to increased compartment pressure. Intra compartmental pressures of greater than 30 mm of Hg (normal: less than 10 mm of Hg) significantly impair the arterial circulation and are indicative of compartment syndrome.^[7] Upper extremity deformity of ischemic contracture usually includes elbow flexion, forearm pronation, wrist flexion, thumb flexion and adduction, digital metacarpophalangeal joint extension and interphalangeal joint flexion.^[8] All these factors are apparently from the external trauma at the *Ani Marma* site only.

DISCUSSION

Brachial artery is the major structure present at the site of *Ani Marma* i.e., 3 *Anguli* above the level of *Kurpara Sandhi*. It is the main artery which supplies entire upper limb. The main trunk of it supplies the arm and its terminal divisions ulnar and radial arteries supply the forearm. Even the hand is also supplied by the branches and arterial arches formed by ulnar and radial arteries. So, any obstruction of the brachial artery or its injury obviously hampers the blood supply of muscles of arm, forearm and hand too.

The improper blood supply to the muscles of the upper limb leads to the necrosis of muscle fibres. These changes are more pronounced on the flexor compartment of the forearm. Because of these changes, the muscle fibres become shortened and permanent flexion contracture occurs at the wrist. The shortened and fibrosed muscles can cause increase in the circumference of forearm. This fact can be correlated with "*Shophabhivridi*" as explained by *Sushruta*. The shortening of the muscles of the hand causes flexion contracture of metacarpo-phalangeal and interphalangeal joints too. The injury to the biceps and brachialis situated at *Ani Marma* site hampers the flexion of the elbow joint which restricts the movement of forearm. These pathological changes finally result in a peculiar claw-like deformity at the hand making the entire upper limb disable for any activities. This disability can be correlated with "*Sthabdabahuta*" as explained by *Sushruta*. All the

above symptoms are grouped together and are known as 'Volkman's Ischemic Contracture'.

The changes explained above are mainly due to ischemia caused by injury or spasm of the brachial artery which more likely occurs in supracondylar fractures of the humerus. Brachial artery is a major structure at the site of *Ani Marma*. So, the symptoms which appear due to injury of *Ani Marma* can be correlated to the symptoms of 'Volkman's Ischaemic Contracture'.

CONCLUSION

Ani Marma is one of the delicate and vital points of the body located in the upper limb. The termination of brachial artery can be located exactly at the site of *Ani Marma*. Brachial artery is the major structure which suffers more injury during trauma at the site of *Ani Marma*. Any injury to the brachial artery leads to ischaemic changes in the muscles of the upper limb especially the flexor muscles of the forearm and hand. There will be shortening and necrosis in the muscles of this compartment. This results in the deformity and disability of the entire upper limb as the person cannot use the limb for any activities. These symptoms can be correlated to the *Shophabhivridi* and *Sthabdabahuta* as explained by *Sushruta*. Further the inter relation can be established with the disability of the upper limb due to injury to *Ani Marma* and symptoms of Volkman's ischaemic contracture.

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