

A SYSTEMATIC REVIEW OF *KSHIPRA MARMA* W.S.R. TO ANATOMICAL STRUCTURES INVOLVED AND TRAUMATIC EFFECTS PRODUCED

Dr. Arya Devaki V. N.*¹, Dr Kaveri Babruwan Patil²

¹Assistant Professor, Department of Rachana Shareera, SDM College of Ayurveda and Hospital, Hassan, Karnataka.

²MD scholar, Rachana Shareera, ITRA Jamnagar, Gujarat.

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*Corresponding Author: Dr. Arya Devaki V. N.

Assistant Professor, Department of Rachana Shareera, SDM College of Ayurveda and Hospital, Hassan, Karnataka.

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ABSTRACT

Marmas are classified on the basis of their *Rachana*, distribution, *Vikalpa*, and *Angula Pramana*. The effect of trauma depends on the structure present there and the extend of injury. Here is a systematic review of *Kshipra Marma*, emphasizing the anatomy and the traumatic effects produced. By using the keywords *Kshipra* and *Marma*, 277 articles were found in Google Scholar out of which six articles were analyzed. Most of the studies describes tendon or nerve injury as responsible for deformity, and either hypovolemic shock or tetanus as the cause of mortality in *Kshipra Marma* injury. Tetanus usually occurs following an open wound- to any part of body- due to contamination with soil, manure, or rusty metal. But tetanus can also occur following other conditions like burns, ulcers, middle ear infection, inadequate umbilical cord hygiene, etc. Thus, tetanus may occur due to other causes and not strictly due to *Kshipra Marma* injury. But *Acharya* has described '*Akshepakena Maranam*' for *Kshipra Marma Vyadha*. A detailed anatomical analysis suggests that the traumatic effects of *Kshipra Marma* extend to other conditions that affect the tendons, ligaments, and nerves of the first web space, leading to the consideration of conditions like De Quervain's tenosynovitis, traumatic rupture of the ulnar collateral ligament, and complex regional pain syndrome in *Kshipra Marma* injuries.

KEYWORDS: *Kshipra Marma*, *Rachanatmaka Bheda*, *Snayu Marma*, Traumatic effects, Tetanus.

INTRODUCTION

Marmas are vital points in *Sharira*, which are the sites to be protected from injury and are to be avoided from surgeries when possible. *Marma* is often described as landmarks for surgical and para surgical procedures. The one hundred and

seven Marmas are classified on the basis of their Rachana,^[1,2] distribution in Shadanga,^[3] Vikalpa^[4] and Angula Pramana.^[5] The effect of trauma depends on the main structure present there and the depth of injury. Kshipra is a Snayu Marma of half Angula size.^[2,5] Its injury causes Marana due to Akshepaka.^[6] Marana can happen within 15 to 30 days and some times it causes Sadhyapranaharatwa also.^[4] Here is a systematic review of Kshipra Marma emphasizing the Rachanatmaka Bheda and the traumatic effects produced. For this purpose, most relevant studies on Kshipra Marma in Google Scholar were studied and analyzed.

METHODOLOGY

By using the keywords *Kshipra* and *Marma*, 277 articles were found in Google Scholar, out of which seven were exclusively related to the anatomical structure and its relationship with the traumatic effects produced in *Kshipra Marma* injury. One study was excluded due to the inadequacy of references. Six articles were studied and analyzed. Figure 1 shows the PRISMA flowchart for the selection of articles in the systematic review.

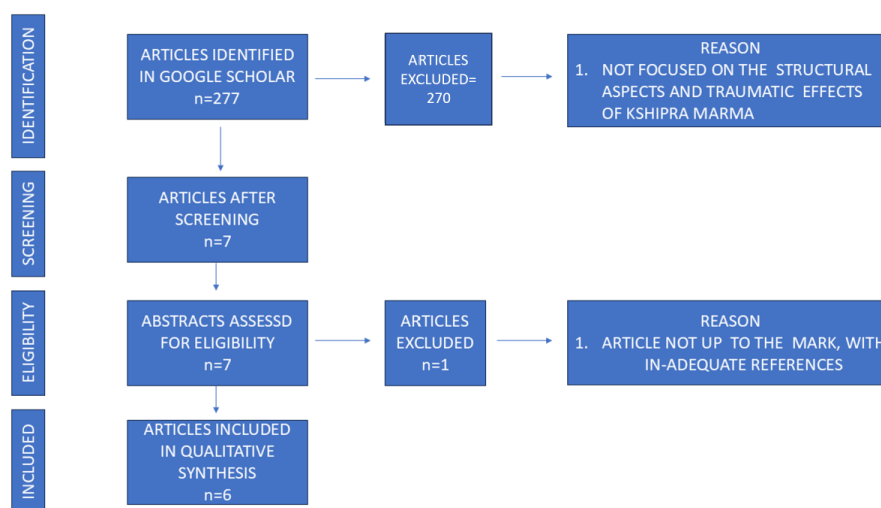


Fig. 1: PRISMA flow chart showing the selection of articles for systematic review.

In 'Conceptual study of *Kshipra Marma*' by Namrita Bhadouria *et al.*, structures present in *Urdhwa Shakhagata Kshipra* are Radialis indicis artery, Princeps pollicis artery, Deep branch of radial artery that proceeds to form deep palmar arch, recurrent branch of median nerve which supplies the thenar muscles, and flexor pollicis longus. Three proper palmar digital nerves of the lateral branch of the median nerve, the first lumbrical, the first palmar interossei, the transverse and oblique head of the adductor pollicis, the radial bursa, the superficial terminal branch of the radial nerve & its dorsal digital branches. *Kshipra Marma* in *Adho Shakha* are combined tendons of the abductor hallucis and flexor hallucis brevis muscles, the bifurcation of the first common digital nerve, the dorsal pedis artery, the lumbricalis muscles, the posterior tibial nerve, the plantar arch and the medial plantar artery, the bifurcation of the first dorsal metatarsal artery and metatarso-phalangeal joint. *Kshipra Marmabhighata* causes *Akshepaka* and *Marana* due to injury to the dorsal metacarpal artery or palmar arch leading to excessive blood loss and *Vata Prakopa*, which may result in a *Vata Vyadhi* known as *Akshepaka*. *Vayu* entering into *Dhamani* may cause spasm and convulsions. Another possibility mentioned in the article is the *Clostridium tetani* infection. The incubation period of *Clostridium tetani* is between 4 to 14 days, which matches with *Kalantara Pranharatwa* of *Marma* (*Marana* within 15-30 days after injury).^[7]

In the study titled 'Understanding *Kshipra Marma*– A Conceptual Exploration from Modern and *Sushruta*'s perspectives' by Dr Sadhana Sharma *et al.* *Kshipra* in the upper limb is associated with the recurrent branch of the median nerve, the princeps pollicis artery, and the first lumbrical muscle. In the lower limb, it is associated with the deep peroneal nerve, dorsalis pedis artery, and tendons such as flexor hallucis brevis. Hypovolemic shock and convulsions may occur due to severe blood loss. The pathology may align with neurovascular collapse, neurogenic shock also and infections like tetanus.^[8]

In the study of Dr. Neelam Dhabhai *et al.*, entitled as 'Unveiling the Energetic Nexus: A Comprehensive Study of *Kshipra Marma*', author suggests that *Acharya Sushruta* categorized *Kshipra Marma* under *Snayu Marma* because he may have considered majority of the intrinsic muscles in hand as *Snayu*, owing to their small size. An injury to the palmar arch or dorsal metacarpal artery may result in severe hemorrhage, successive *Vata* aggravation, and convulsions due to invasion of *Dhamani*. Tetanus has been mentioned as a possible cause of *Akshepaka* and *Marana*.^[9]

In 'Conceptual study of *Kshipra Marma* w.s.r. to its traumatic result' by Priyanka Upadhyay *et al.* structures described are: in the upper limbs, the tendon of the first palmar interosseous muscle, the first palmar metacarpal artery, the first dorsal interosseous muscle, first dorsal metacarpal artery. In the lower limbs, the tendon of the extensor hallucis brevis muscle, the first dorsalis pedis artery, the first dorsal interosseous muscle, the first plantar metatarsal artery, the tendon of the flexor hallucis brevis muscle, first metatarsal artery. Hypovolemic shock may occur in *Kshipra Marma Vyadha* due to injury of the 1st metatarsal artery or the 1st metacarpal artery. Authors points this as the reason why in *Kshipra Marma* injury, hands and feet should be amputated quickly at the wrist and ankle, respectively. The *Akshepaka* mentioned in the *Marma Vidha Lakshana* can be the *Vatavyadhi* as described by *Arundatta*. Authors emphasized that the labourers who work in paddy areas are prone to get injured in *Kshipra Marma* and they may easily infected by *Clostridium tetani*.^[10]

In 'A review on anatomical study of *Kshipra Marma*' Dr. Lipi Raturi describes that *Kshipra Marma* is situated in the first intermetacarpal space. Upper limb structures involved and surrounding the *Kshipra Marma* are tendon of adductor pollicis, first dorsal interosseous muscle, flexor pollicis longus, digital branches of median nerve, first palmar interosseous muscle, three thenar muscles; abductor pollicis brevis muscle and flexor pollicis brevis, indicis artery, princeps pollicis artery, dorsal meta carpal artery, cephalic vein, recurrent branch of median nerve and superficial branch of radial nerve. Injury may cause loss of function of abduction of the index and thumb, loss of abduction of meta carpal phalangeal joint and severe bleeding from the palmar arch. Lower limb structures include the muscles attachment of abductor hallucis, extensor hallucis longus, flexor hallucis brevis, first dorsal interosseous muscle, adductor hallucis brevis, extensor hallucis brevis, medial plantar artery, dorsalis pedis artery, posterior tibial artery, first dorsal metatarsal artery, deep plantar artery, medial malleolus vein, deep fibular nerve and superficial fibular nerve. Injury may impair the functions of abducts and flexion of greater toe, loss of function of flexion of meta tarsal phalangeal joint. According to the location as described here, it can be located in the first intermetatarsal space. Here, two important anatomical structure emphasized are; first dorsal metatarsal artery and a branch of the deep peroneal nerve going to the big toe. In case of injury to this *Marma*, death takes place due to convulsions. The convulsions may be toxic in nature and occurs in the condition like bleeding or in tetanus bacilli infection.^[11]

In 'The conceptual study of *Sadyopranharatva of Kalantarpranhara Kshipra Marma*' by Dr Jeeshan Khan *et al* describes *Kshipra* is a *Snayu Marma* because *Acharya Sushruta* probably categorized most of the 20 intrinsic muscles

as *Snayu*. Comparison of the *Sadyapranaharatva* of *Kshipra Marma* on upper and lower limbs has been done in the study, and the *Kshipra Marma* of the lower limb was found to be more severe than the upper limb because of more blood loss from the lower limb in traumatic injury.^[12]

Summary of articles on *Kshipra Marma*

Table 1: summarizes the studies on *Kshipra Marma*.

Sl. No.	JOURNAL	AUTHOR	TITLE	ANATOMICAL STRUCTURES INVOLVED	EFFECTS OF TRAUMA
1.	World Journal of Pharmaceutical Research.	Namrita Bhadouria <i>et al.</i>	Conceptual study of <i>Kshipra Marma</i> .	UL: Radialis indicis artery, Princeps pollicis artery, Deep branch of radial artery, recurrent branch of median nerve LL: tendon of abductor hallucis and flexor hallucis brevis muscles, bifurcation of first common digital nerve, dorsal pedis artery, lumbricalis muscles, posterior tibial nerve, plantar arch and medial plantar artery, bifurcation of first dorsal metatarsal artery and metatarso-phalangeal joint.	Excess blood loss leading to <i>Akshepaka Vata Vyadhi</i> OR Tetanus infection
2.	International Journal of Research in AYUSH	Dr. Sadhana Sharma <i>et al.</i>	Understanding <i>Kshipra Marma</i> – A Conceptual Exploration from Modern and <i>Sushruta's</i> Perspectives.	UL: recurrent branch of the median nerve, the princeps pollicis artery, and the first lumbrical muscle. LL: deep peroneal nerve, dorsalis pedis artery, and tendons such as flexor hallucis brevis.	Vascular rupture, convulsions, neurogenic shock or delayed death due to infections like tetanus.
3.	International Journal for Research in Applied Science & Engineering Technology (IJRASET)	Dr. Neelam Dhabhai <i>et al.</i>	Unveiling the Energetic Nexus: A Comprehensive Study of <i>Kshipra Marma</i> .	UL: the 20 intrinsic muscles in hand. LL: not described	Tetanus or injury to the palmar arch or dorsal metacarpal artery resulting in excessive bleeding or cyanosis.
4.	Journal of emerging technologies and innovative research	Dr. Jeeshan Khan <i>et al.</i>	Conceptual study of <i>Kshipra Marma</i> w.s.r. to its traumatic result.	UL: the tendon of the first palmar interosseous muscle, first palmar metacarpal artery, the first dorsal interosseous muscle, first dorsal metacarpal artery. LL: the tendon of extensor hallucis brevis muscle, first dorsalis pedis artery, first dorsal interosseous muscle, first plantar metatarsal artery, tendon of flexor hallucis	First metacarpal artery or palmar arch (in the upper limb) or the first plantar metatarsal artery or plantar arch (in the lower limb) may lead to hypovolemic shock, here sudden death may occur. Tetanus is another possibility.

				brevis muscle, first metatarsal artery.	
5.	World Journal of Pharmaceutical Research	Dr. Lipi Raturi	A review on anatomical study of <i>Kshipra Marma</i>	Structures involved and surrounded the <i>Kshipra Marma</i> are described. UL: first inter meta carpal space. LL: first inter meta tarsal space containing first dorsal meta tarsal artery, branch of the deep peroneal nerve going to big toe.	Loss of function of abduction of index and thumb, loss of abduction of meta carpal phalangeal joint and severe bleeding from the palmar arch. Injury to lower limb <i>Kshipra Marma</i> may impair the functions of abducts and flexion of greater toe and loss of function of flexion of meta tarsal phalangeal joint. Convulsions may be toxic in nature and can be due to bleeding or in the tetanus bacilli infection.
6.	Journal of emerging technologies and innovative research	Dr. Jeeshan Khan et al.	The Conceptual Study of <i>Sadyopranharatav</i> of <i>Kalantarpranhara Kshipra Marma</i>	UL: 20 internal muscles in hand LL: not described	<i>Sadyapranaharatwa</i> is due to severe blood loss. <i>Sadyapranaharatwa</i> of lower limb is more severe than that of upper limb.

DISCUSSION

Most of the studies identified tendon or nerve injury as responsible for deformity and either hypovolemic shock due to blood vessel damage or tetanus as the cause of mortality in *Kshipra Marma* injury.

Tetanus

Tetanus usually occurs following an open wound due to contamination with soil, manure, or rusty metal. But tetanus can also occur following complicated burns, ulcers, necrotic snake bites, septic abortions, childbirth, injections, surgery and even middle ear infection. Nearly 25% of tetanus cases do not even present with the evidence of a recent open wound.^[13]

Pathology of tetanus: Interneurons that normally inhibit alpha motor neurons are affected initially, resulting in loss of inhibitory control over motor activity. As the condition progresses, the preganglionic sympathetic neurons located in the lateral horns and the parasympathetic centers are also involved. The affected motor neurons release reduced amounts of acetylcholine into the neuromuscular junction. Muscle spasms can differ in intensity and frequency, ranging from mild episodes to severe contractions capable of causing fractures and tendon avulsions. In some cases, the spasms become continuous and may lead to respiratory failure.^[14]

Neonatal tetanus (tetanus neonatorum) is a major contributor to tetanus-related mortality worldwide, accounting for more than half of the deaths. Inadequate umbilical cord hygiene is the primary cause of this condition.^[13]

The incubation period, defined as the interval between injury and the appearance of the first symptom, is usually 7–10 days but may range from 1 to 60 days. The onset period varies from 1–7 days, and shorter incubation or onset periods are generally linked with more severe disease. During the first week, patients experience muscle rigidity and

progressively worsening spasms. Autonomic disturbances typically appear a few days later and may continue for 1–2 weeks. Although spasms usually decrease after 2–3 weeks, muscular stiffness can persist for a longer duration.^[13]

The review of reported cases of tetanus demonstrates that it is not possible to clinically determine which wounds are tetanus-prone, as tetanus can occur after minor, seemingly innocuous injuries, yet is rare after severely contaminated wounds.^[14] So it is clear that tetanus may occur due to any open injury or infection, like middle ear infections, and not strictly due to *Kshipra Marma Vyadha*. An open injury to *Kurcha* or *Kurcha Shira* can also lead to tetanus. But *Acharya* has described '*Akshepakena Maranam*' for *Kshipra Marma Vyadha* only.

The injury to the first web space of the extremities may extend the scope of study to some other conditions that affect the tendons and nerves there.

Other conditions resulting from acute injury to the first web space

- De Quervain's tenosynovitis: It can be defined as a stenosing tenosynovitis of the hand's first radio-dorsal compartment, characterized by localized pain, swelling, and restricted movement of the thumb. It is caused by inflammation of the tendons on the lateral side of the wrist that control the movement of the thumb, specifically the abductor pollicis longus (APL) and extensor pollicis brevis (EPB).^[15]

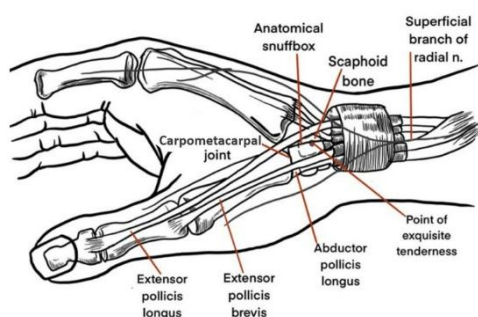


Fig. 2: Image showing the tendons involved in De Quervain's tenosynovitis.^[15]

- Ape hand deformity: Ape thumb deformity is caused by damage to the recurrent motor branch of the median nerve, resulting in the denervation of muscles of the thenar eminence and loss of function. Damage to the median nerve typically occurs at either the elbow or the wrist, but can also occur following a deep penetrating injury or blunt force trauma to the arm, forearm, or hand.^[16]
- Traumatic rupture of the ulnar collateral ligament (UCL): due to sports injury, pain and swelling in the UCL or at the base of the thumb, with declined range of motion of the metacarpophalangeal (MCP) joint of the thumb.^[17] Stener lesions is described as an interposition of the adductor aponeurosis of the thumb due to a total rupture of the UCL of the MCP joint of the thumb.^[18]
- Complex Regional Pain Syndrome (Reflex Sympathetic Dystrophy): Complex regional pain syndrome (CRPS) is a condition most probably occurring due to short circuit in the nervous system is characterized by burning pain, stiffness and swelling along with discoloration of the affected part. Symptoms mostly affect the hand; however, it may also affect the arm, leg, and foot. It has three stages; first stage may last up to three months, presenting with symptoms like burning pain and increased touch sensitivity. Stage II can last 3 to 12 months. In this stage, the predominant feature is swelling, and the skin temperature becomes cooler. Fingernails may become brittle due to poor oxygen supply. Stage III is atrophic; it occurs after one year. The skin of the affected area becomes pale and

may appear blanched, desiccated and tense. The area is stiff, and there is less chance of recovery. The condition can spread to other areas of the body. CRPS may occur following an injury or due to illness but the exact etiology is not known. An overactivity of the sympathetic nervous system affecting the blood flow and sweat glands is postulated as the pathology of events in CRPS.^[19]

CONCLUSION

Almost all the studies on *Kshipra Marma* upholds the anatomical structures involved and depicts how these structures contribute to morbidity and death. Injury to the tendon of abductor pollicis longus (APL), extensor pollicis brevis (EPB) and extensor pollicis longus (EPL) may result in hand deformities, and injury to extensor hallucis brevis (EHB) and extensor hallucis longus (EHL) may cause deformities of the foot. Injury can occur to the recurrent median nerve in the hand or the deep peroneal nerve of the foot may cause motor dysfunction. Blood loss due to rupture of first metacarpal artery and plantar metatarsal artery may result in hypovolemic shock and subsequent death. Since the '*Akshepakena marana*' and '*Kalantara Pranaharatwa*' (often *Sadyapranaharatwa*) has been described in classics, the condition of tetanus can be considered but the scope of study should be extended to other conditions like De Quervain's tenosynovitis, traumatic rupture of the ulnar collateral ligament and complex regional pain syndrome.

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