

Marma Sharir In Shalya Tantra: A Conceptual Correlation with Modern Microsurgery

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Abstract—Marma Sharir, described by Acharya Sushruta in the Sharira Sthana of the Sushruta Samhita, is among the earliest systematic accounts of surgically vulnerable anatomical zones, a Marma being a site where Mamsa, Sira, Snayu, Asthi and Sandhi converge and where injury produces effects disproportionate to the extent of tissue damage. This review examines the conceptual architecture of Marma Sharir and its correlation with the anatomical and operative principles of modern microsurgery. A narrative review of classical Ayurvedic texts and contemporary indexed literature was undertaken, focusing on anatomical, clinical and trauma-related correlations between Marma and modern neurovascular and musculoskeletal structures. Sushruta enumerated 107 Marma, classified by location, structural predominance, dimension and, most importantly, the prognosis of injury, in effect an operative hazard map. Correlation studies show Marma sites consistently overlying dense neurovascular confluences, the same zones microsurgery approaches under magnification with fine instrumentation, while parasurgical techniques such as Jalaukavacharana parallel hirudotherapy used in flap salvage. Marma Sharir thus anticipates, in descriptive form, many neurovascular danger zones central to modern microsurgery and offers a historically continuous, pedagogically valuable framework for surgical anatomy training; rigorous anatomical validation is needed before this correlation can move from conceptual to clinically applied.

Index Terms—Ayurveda, Marma Sharir, Microsurgery, Neurovascular bundle, Shalya Tantra, Surgical anatomy, Sushruta Samhita.

I. INTRODUCTION

Shalya Tantra, one of the eight clinical branches (Ashtanga) of Ayurveda, is the discipline devoted to

the surgical management of disease and trauma, and Acharya Sushruta, its principal exponent, is widely regarded as the father of surgery [1], [10].

Central to safe surgical practice in the Sushruta Samhita is the doctrine of Marma Sharir, presented as a distinct chapter (Marma Sharira Adhyaya) within Sharira Sthana [1]. Marma is described as vital anatomical points formed by the conglomeration of five structural elements Mamsa, Sira, Snayu, Asthi and Sandhi with one element typically predominating at a given site; because Prana is held to be specially concentrated at these junctions, trauma there produces outcomes ranging from severe pain and deformity to instantaneous death, disproportionate to the visible extent of injury [1], [4], [5].

Sushruta enumerated 107 Marma distributed across the body and classified them by location, structure and, crucially, by the prognosis of injury [1], [6]. This classification was never a purely theoretical exercise: it functioned as a practical operative map intended to guide the ancient surgeon's hand away from zones where instrumentation could prove catastrophic, and toward safer planes of dissection. In this sense, Marma Sharir anticipates a core preoccupation of modern operative surgery the deliberate, anatomically informed avoidance of critical neurovascular and musculotendinous structures during instrumentation.

Modern microsurgery, which employs optical magnification, fine instrumentation and precise dissection to identify, preserve, repair or transfer minute vessels, nerves and tissue planes, shares this underlying philosophy of structural precision, even though it arose from an entirely different epistemic and technological tradition. Recent Ayurvedic literature has increasingly attempted to map Marma

sites onto contemporary neurovascular and musculoskeletal anatomy, and to draw parallels between classical parasurgical procedures — such as leech application (Jalaukavacharana) and thread-based excision (Kshara Sutra) and their modern analogues in reconstructive and microvascular practice [11], [20]. This review consolidates that emerging body of work and offers a structured conceptual correlation between Marma Sharir and microsurgical principles.

II. AIMS AND OBJECTIVES

This review was undertaken with the following objectives:

- To revisit the classical description, structural composition and classification of Marma Sharir as detailed in the Sushruta Samhita and allied Ayurvedic texts.
- To examine the surgical relevance of Marma Sharir within Shalya Tantra, both in classical operative practice and in contemporary clinical teaching.
- To identify conceptual and anatomical points of correlation between Marma Sharir and the principles, techniques and structural priorities of modern microsurgery.
- To outline gaps in current evidence and propose directions for translational and validation research.

III. MATERIALS AND METHODS

This is a narrative review based on classical Ayurvedic texts — principally the Sharira Sthana of the Sushruta Samhita, supplemented by the Charaka Samhita and Ashtanga Hridaya together with their standard commentaries [1]– [3].

Contemporary literature was identified through a structured search of open-access and indexed sources using the terms “Marma Sharir”, “Marma”, “Shalya Tantra”, “Sushruta Samhita surgical anatomy” and “microsurgery neurovascular anatomy”. Articles addressing the anatomical, clinical or trauma-related correlation of Marma with modern structures were prioritised. Standard textbooks of human anatomy and microsurgical technique were consulted for correlating modern terminology.

Because Marma Sharir is a descriptive anatomical doctrine rather than an experimentally validated

surgical protocol, this review is conceptual and comparative in nature rather than a systematic or outcomes-based review.

IV. CONCEPTUAL REVIEW OF MARMA SHARIR

A. Definition and Etymology

The term Marma is derived from the Sanskrit root “mri” (to die), and is classically defined by the aphorism “Marayanti iti Marmani” the sites whose injury may cause death [1], [5]. Sushruta further specifies Marma as “Jeevasthanam”, a seat of life, distinguishing it from ordinary soft-tissue landmarks by the concentration of Prana held to reside there [1].

B. Structural Composition (Rachana Sharir)

Each Marma is described as a composite structure formed by the union of five elements — Mamsa (muscle), Sira (vessels/channels), Snayu (ligaments and tendinous structures), Asthi (bone) and Sandhi (joints) with one component typically predominant at a given site [1], [4], [22].

On this basis Marma are further sub-classified as Mamsa Marma, Sira Marma, Snayu Marma, Asthi Marma and Sandhi Marma, a scheme that closely parallels the modern description of anatomical regions in terms of their dominant musculoskeletal, vascular or articular components.

C. Classification of Marma

Sushruta classified the 107 Marma along four principal axes: anatomical location (Shadanga Sharir distributed across the four limbs, trunk and head-and-neck region), structural predominance (Rachana, described above), physical dimension (Pramana, measured in Angula), and of greatest clinical importance to the surgeon the prognostic effect of injury (Parinama) [1], [4], [6].

The head-and-neck region alone accounts for a disproportionately large share of Marma, reflecting its density of vital neurovascular and sensory structures [13].

The prognostic classification divides all 107 Marma into five categories, summarised in Table I.

TABLE I Classification of Marma According to the Effect of Injury (Parinama)

Category	Sanskrit Term	Clinical Outcome of Injury	No.
1	Sadyahpranahara	Death occurs almost immediately after injury	19
2	Kalantarapranahara	Death occurs after a delay, classically within 7–30 days	33
3	Vishalyaghna	Life sustained only until the embedded foreign body (Shalya) is removed	3
4	Vaikalyakara	Permanent deformity or functional disability without death	44
5	Rujakara	Severe localised pain with minimal tissue loss and no lasting disability	8

This five-tier prognostic scheme functions as an early triage and operative-risk framework: it allowed the ancient surgeon to anticipate, before instrumentation, whether a given region carried a risk of immediate exsanguination or death, delayed systemic compromise, foreign-body-dependent survival, permanent disability, or purely painful but non-disabling injury a logic that maps closely onto the modern surgical concept of zone-of-risk classification prior to dissection near named neurovascular structures.

V. MARMA SHARIR AND SHALYA TANTRA: CLASSICAL SURGICAL RELEVANCE

Within the Sushruta Samhita, the description of Marma is placed deliberately alongside chapters on surgical instrumentation, incision (Chedana), excision (Bhedana), and the eight surgical procedures (Ashta

Vidha Shastra Karma), underscoring that Marma Sharir was conceived as applied operative anatomy rather than isolated theory [1], [9], [10]. Surgeons were instructed to identify the position, depth and extent of a Marma before undertaking Vrana Chikitsa (wound management), Shastra Karma (instrumental procedures) or Kshara/Agni Karma (caustic or thermal procedures), and to modify the angle, depth and technique of instrumentation accordingly. This is functionally analogous to the modern surgical requirement of mapping named danger zones such as the facial nerve in parotid surgery or the recurrent laryngeal nerve in thyroidectomy before an incision is placed.

Contemporary postgraduate curricula in Shalya Tantra continue to treat Marma Sharir as foundational surgical anatomy, and Indian regulatory bodies overseeing Ayurvedic surgical training have progressively mandated exposure to modern surgical technique for Shalya Tantra postgraduates, reflecting an explicit institutional effort to align classical Marma-based anatomical training with contemporary operative competence [9].

VI. CORRELATION WITH MODERN ANATOMY AND MICROSURGERY

A. Marma as Neurovascular and Musculotendinous Confluences

A recurring observation in recent anatomical correlation studies is that Marma sites consistently overlie regions of dense neurovascular concentration points where major arteries, veins and peripheral nerves lie in close proximity to tendons, joint capsules or bone [11]–[13], [18]. Structures such as the Kshipra Marma (web space between the first and second digits) [15], [16], Kurcha and Kurchashira Marma (peritendinous zones near the wrist and ankle) [14], [17], Indrabasti and Talahridaya Marma (mid-forearm/leg and palm/sole respectively) [14], [16], and Vidhura Marma (retro-auricular region, correlated with the posterior auricular vessels and facial nerve) [18] have each been individually mapped to specific neurovascular bundles in cadaveric and radiological correlation studies. This convergence is precisely the anatomical substrate that microsurgeons must identify, preserve or, where necessary, dissect and repair under magnification.

B. Shared Operative Philosophy: Precision Over Force

Microsurgery is defined by its dependence on optical magnification (loupes or the operating microscope), fine-gauge instruments, and sutures finer than the naked eye can reliably place, in order to work within millimetre tolerances around vessels and nerves as small as 0.3–3 mm in diameter. Classical Marma doctrine, though lacking magnification, embodies an analogous philosophy: it explicitly cautions against forceful, deep or careless instrumentation near vital points, favouring instead deliberate, structure-aware technique calibrated to the specific composition (Sira,

Snayu, Asthi, Sandhi or Mamsa predominant) of the site being approached [1], [4]. Both traditions therefore converge on the same operative principle — that outcome is determined less by the extent of tissue handled than by the precision with which critical structures are respected.

C. Selected Anatomical Correlations

Table II summarises representative correlations proposed in the Ayurvedic and integrative-anatomy literature between individual Marma and modern neurovascular or musculoskeletal structures relevant to microsurgical practice [14]–[18].

TABLE II Representative Correlation of Marma with Modern Surgical Anatomy

Marma	Classical Category	Proposed Modern Correlate	Microsurgical Relevance
Kshipra (hand/foot)	Rujakara, Snayu Marma	First dorsal web space; deep palmar/plantar arch and digital nerve origin	Landmark in digital nerve/vessel exploration and web-space flap surgery
Kurcha / Kurchashira	Vaikalyakara / Rujakara, Snayu Marma	Peritendinous and ligamentous complex near wrist and ankle	Tendon transfer and peritendinous microvascular repair
Talahridaya (palm/sole)	Kalantarapranahara, Mamsa Marma	Superficial palmar/plantar arch region	Major vascular arcades relevant to replantation surgery
Manibandha / Gulpha	Vaikalyakara / Rujakara, Sandhi Marma	Wrist and ankle joint neurovascular bundle	Nerve and vessel preservation in joint-adjacent dissection
Vidhura (retro-auricular)	Sira Marma	Posterior auricular vein, facial nerve, external auditory canal region	Safe dissection in otologic and facial-nerve microsurgery
Kurpara / Janu (elbow/knee)	Vaikalyakara, Sandhi Marma	Cubital and popliteal neurovascular bundle	Danger zones in elbow/knee flap and nerve-repair surgery
Hridaya (cardiac region)	Sadyahpranahara, Sira/Sandhi Marma	Heart and great-vessel complex	Zones of catastrophic vascular risk in thoracic microvascular work

D. Parasurgical Ayurvedic Techniques and Microsurgical Analogues

Beyond direct anatomical correlation, several parasurgical Shalya Tantra techniques described alongside Marma Chikitsa find structural parallels in microsurgical and reconstructive practice. Jalaukavacharana, the application of medicinal leeches, parallels hirudotherapy, which remains a recognised adjunct for relieving venous congestion in compromised free flaps and digit replantation [20]. Kshara Sutra, the medicated-thread technique used chiefly in ano-rectal fistula management, has been the most rigorously validated Shalya Tantra intervention

to date and illustrates the translational pathway — from classical description to controlled clinical evaluation — that Marma-based anatomical claims would similarly need to follow before they can be considered evidence-based rather than descriptive [20].

E. Convergence with Trigger-Point and Neuro-Reflex Mapping

A number of authors have additionally noted overlap between Marma sites and myofascial trigger points, acupuncture loci described in Traditional Chinese Medicine, and cutaneous reflex zones, suggesting that

independent anatomical traditions repeatedly identified the same structurally privileged points of neurovascular convergence [13], [21]. While such cross-system convergence is suggestive, it remains largely descriptive and correlational rather than mechanistically established, and should be interpreted cautiously pending controlled anatomical and neurophysiological study.

VII. CLINICAL AND EDUCATIONAL APPLICATIONS

Framing Marma Sharir in microsurgical terms has practical value in at least three domains:

- Surgical anatomy training: teaching Marma sites as neurovascular danger zones gives Shalya Tantra postgraduates a structured, clinically framed entry point into regional surgical anatomy relevant to modern operative and microsurgical technique.
- Trauma triage: the five-tier Parinama classification offers a rapid, structure-based framework for anticipating the severity of injury at specific body sites in emergency and trauma settings, complementing modern trauma scoring systems.
- Integrative rehabilitation: Marma-based manual therapy (Marma Chikitsa) is increasingly explored as an adjunct in post-surgical and post-traumatic rehabilitation, including after microsurgical flap or nerve-repair procedures, on the premise that stimulation at neurovascularly dense points may influence local circulation and neural recovery [19].

VIII. DISCUSSION

The correlation between Marma Sharir and modern microsurgery is best understood as convergent anatomical observation arising from two very different investigative traditions. Sushruta's system was built from external inspection, palpation, battlefield and ritual-sacrifice-derived anatomical knowledge, and centuries of empirical correlation between injury site and clinical outcome, codified without dissection-based imaging or magnification. Modern microsurgery, by contrast, rests on dissection-verified, imaging-confirmed anatomy visualised under the operating microscope. That both traditions repeatedly converge on the same anatomical hotspot's digital web spaces, peritendinous zones, retro-auricular and

popliteal/cubital regions, palmar and plantar arches lend some support to the view that Marma sites reflect genuine, structurally privileged anatomical junctions rather than arbitrary constructs [11], [12], [18].

At the same time, several limitations temper any strong claim of equivalence. First, the correlation literature to date is largely descriptive, based on textual interpretation, small cadaveric series, or narrative comparison, rather than systematic dissection studies, cross-sectional imaging cohorts, or blinded anatomical validation. Second, classical Marma dimensions (measured in Angula, a body-proportionate unit) do not map in any fixed way onto metric anatomical measurements, complicating precise localisation. Third, the prognostic categories for example, the 15–30-day timeframe attributed to Kalantarapranahara injury reflect pre-modern clinical observation of untreated trauma and cannot be directly extrapolated to outcomes under contemporary resuscitative and surgical care [6], [8]. Finally, terms such as Prana and the vitalistic framing of Marma injury belong to a physiological model distinct from, and not reducible to, modern neurovascular pathophysiology; correlation of anatomical location does not by itself validate the classical explanatory mechanism.

The most productive use of this correlation, therefore, is pedagogical and hypothesis-generating rather than a claim of direct clinical equivalence: Marma Sharir offers a structured, historically continuous map of anatomically vulnerable zones that can orient learners toward the same regions modern microsurgical anatomy identifies as critical, while the burden of clinical validation must be carried by dissection-based and imaging-based research conducted to contemporary methodological standards.

IX. LIMITATIONS AND FUTURE DIRECTIONS

Future work in this area should prioritise:

- Systematic cadaveric dissection studies correlating each of the 107 Marma with named neurovascular and musculotendinous structures, using standardised metric measurement rather than Angula alone.
- Cross-sectional imaging (ultrasound, CT or MR angiography) studies mapping Marma coordinates onto vascular and neural anatomy in living subjects.

- Controlled clinical studies evaluating whether Marma-informed anatomical teaching improves trainee performance in microsurgical simulation or reduces iatrogenic neurovascular injury.
- Structured inclusion of validated Marma–modern anatomy correlations within Shalya Tantra postgraduate curricula, alongside existing modern surgical anatomy training mandated by national regulatory bodies [9].

X. CONCLUSION

Marma Sharir represents a historically remarkable, clinically motivated system of surgical anatomy that anticipated, in descriptive form, many of the same neurovascular and musculotendinous danger zones that modern microsurgery approaches with magnification, fine instrumentation and image guidance. The five-tier prognostic classification of Marma injury, in particular, parallels the structure-based risk assessment that underlies safe modern operative planning. While the anatomical convergence between the two systems is genuine and pedagogically valuable, current evidence remains largely descriptive, and rigorous dissection-based and imaging-based validation is required before Marma Sharir can be positioned as more than a conceptual and educational bridge between classical Shalya Tantra and contemporary microsurgical practice. Continued interdisciplinary research in this direction may strengthen the scientific credibility and clinical integration of Ayurvedic surgical science.

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