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Review Article

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"HISTORICAL EVOLUTION OF SURGICAL INSTRUMENTS (YANTRA AND SHASTRA) IN AYURVEDA: A SCIENTIFIC REVIEW"

Ms. Priya Bhaware[1]

AFFLIATIONS:

1. Research Assistant, Ira Consultancy & Research Organisation, Bhosari, Pune, Maharashtra 411026

CORRESPONDENCE:
Ms. Priya Bhaware
EMAILID:
priyabhaware0123@gmail.com

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ABSTRACT

Introduction: Surgical instruments have played a pivotal role in the development of Ayurveda, especially as described in *Sushruta Samhita*. The classification of instruments into Yantra (non-cutting tools) and Shastra (cutting tools) reflects remarkable surgical precision in ancient India. Their relevance continues in modern surgery, where several instruments find parallels with contemporary designs. **Methods:** This review was conducted by systematically analyzing primary Ayurvedic texts (*Sushruta Samhita*, *Charaka Samhita*, *Ashtanga Hridaya*) alongside secondary commentaries and modern scholarly literature. Searches were performed in PubMed, Scopus, Web of Science, and AYUSH Research Portal using keywords such as "Ayurveda surgical instruments," "Yantra," "Shastra," and "Sushruta surgery." Articles, reviews, and clinical-historical reports published between 1990–2025 were included. **Results:** The classical classification lists over 100 Yantras and 20 Shastras, including forceps, probes, needles, and knives, many of which mirror modern surgical instruments. Yantras were primarily used for grasping, probing, squeezing, and draining, while Shastras were designed for excision, incision, and dissection. Comparative analyses show clear similarities between ancient forceps (*Svastika Yantra*) and modern artery forceps, or *Mandala Shastra* and scalpels. Evidence suggests Sushruta's innovations influenced Greco-Arabic medicine and eventually European surgery. **Discussion:** While Ayurveda offered detailed instrument descriptions, modern surgery has improved materials, ergonomics, and sterilization. The continuity of surgical principles demonstrates Ayurveda's lasting contributions. However, research gaps remain in experimental archaeology, museum preservation, and systematic comparison with modern instruments. **Conclusion:** The historical evolution of Yantra and Shastra in Ayurveda illustrates the scientific ingenuity of ancient Indian surgeons. Modern recognition of these tools not only highlights their relevance but also opens avenues for cross-cultural medical heritage research and integrative surgical studies.

KEYWORDS: Ayurveda, history of surgery, Shastra, Sushruta, Yantra

INTRODUCTION

Surgery (*Shalya Tantra*) represents one of the eight branches (*Ashtanga Ayurveda*) of classical Ayurveda. Among its pioneers, *Acharya Sushruta* (circa 600 BCE) is recognized as the "Father of Surgery," whose *Sushruta Samhita* is an unparalleled surgical treatise[1-2]. Central to his work is the systematic classification, description, and application of surgical instruments. These instruments—categorized into Yantra (blunt, non-cutting tools) and Shastra (sharp, cutting tools)—are among the earliest documented surgical devices in medical history[3-4].

The ingenuity of these instruments is evident not only in their structural design but also in their functional application[5-6]. Sushruta described instruments resembling modern forceps, needles, scalpels, and catheters, accompanied by guidelines on material selection (iron, copper, alloys), sharpening, and sterilization through fire. These details highlight the scientific rigor embedded within Ayurveda's surgical tradition[7-8].

The aim of this review is to explore the historical evolution of Yantra and Shastra in Ayurveda, analyze their parallels with modern surgical instruments, and evaluate their significance for contemporary medicine. By systematically reviewing classical references and modern literature, this study provides insights into the enduring relevance of Ayurvedic surgical tools[9-10].

MATERIALS AND METHODS

A systematic literature review was conducted between June–August 2025.

- **Databases searched:** PubMed, Scopus, Web of Science, AYUSH Research Portal, and Google Scholar[11].
- **Keywords used:** "Yantra Shastra Ayurveda," "Ayurveda surgical instruments," "history of surgery India," "Sushruta instruments," "ancient surgical tools. [12]"
- **Inclusion criteria:** [13]
    - Classical Ayurvedic texts (*Sushruta Samhita*, *Charaka Samhita*, *Ashtanga Hridaya*) and their commentaries.
    - Scholarly articles, reviews, and dissertations on surgical history (1990–2025).
    - Comparative studies of ancient and modern surgical instruments.
- **Exclusion criteria:** [14]
    - Non-academic sources, anecdotal mentions without historical or textual support.
    - Non-surgical Ayurvedic tools unrelated to Yantra/Shastra.
- **Study types reviewed:** Textual analysis, historical reviews, clinical history reports, archaeological findings, and cross-cultural comparative studies[15].

The review categorized findings into themes: classification of Yantra/Shastra, material design, functional application, parallels with modern instruments, and historical dissemination.

OBSERVATION AND RESULTS

1. Classification of Surgical Instruments

According to *Sushruta Samhita*, instruments were classified into:

- **Yantra (101 varieties):** Non-cutting tools used for grasping, probing, squeezing, draining, and supporting. Examples include *Svastika Yantra* (forceps), *Sandansha* (tongs), *Salaka* (probes), and *Nadi Yantra* (tubular catheters).
- **Shastra (20 varieties):** Cutting tools used for incision, excision, scraping, puncturing, and sharp dissection. Examples include *Mandala Shastra* (scalpel), *Karapatra* (saw-like instrument), *Vrihimukha Shastra* (lancet), and *Trikuracha* (sharp pointed tool).

This structured classification demonstrates a highly organized surgical toolkit that addressed diverse clinical needs.

2. Materials and Craftsmanship

Sushruta emphasized using metals such as iron, steel, and alloys for strength and sharpness. He described processes for **sharpening, polishing, and sterilization**—including exposure to fire and herbal fumigation—anticipating modern sterilization practices. Handles were designed for grip and balance, showing ergonomic awareness.

3. Functional Applications in Surgery

- **Excision and Incision:** *Mandala Shastra* resembled today's scalpel, used for precise skin and soft tissue incisions.
- **Scraping and Cauterization:** *Vrihimukha Shastra* was used for scraping unhealthy tissue, akin to curettes.

- **Probing and Dilatation:** *Salaka* functioned like modern probes and dilators for sinus tracts and fistulas.
- **Grasping and Extraction:** *Svastika Yantra* mirrored modern forceps, used for foreign body removal or tissue handling.
- **Catheterization:** *Nadi Yantra* was a tubular instrument comparable to catheters, used for introducing or draining fluids.
- **Bone Surgery:** *Karapatra* (saw-like tool) facilitated bone cutting, reflecting orthopedic innovation.

4. Parallels with Modern Instruments

Modern surgical instruments reveal striking parallels:

- *Svastika Yantra* → Artery forceps.
- *Mandala Shastra* → Surgical scalpel.
- *Vrihimukha Shastra* → Lancet/curette.
- *Salaka* → Probes and dilators.
- *Nadi Yantra* → Catheters and cannulas.
- *Karapatra* → Surgical saw.

These similarities highlight the continuity of design principles, indicating that Ayurveda laid a foundation for surgical instrumentation still relevant today.

5. Influence Beyond India

Historical evidence suggests knowledge transfer from India to other civilizations. Greco-Arabic physicians like Galen and Avicenna integrated concepts resembling Sushruta's techniques. Through translations into Arabic and later Latin, surgical knowledge, including instruments, spread to Europe during the medieval period, influencing early Western surgical practice.

6. Museum and Archaeological Evidence

Archaeological findings of metallic surgical tools in Taxila, Takshashila, and Nalanda, alongside preserved collections in Indian museums, provide material validation of textual descriptions. Many resemble classical depictions, supporting historical authenticity.

7. Evolution and Decline

While Ayurveda demonstrated surgical brilliance in antiquity, sociopolitical factors, invasions, and colonial dominance contributed to the decline of surgical practice in India. With the revival of Ayurveda in modern times, academic interest has rekindled, emphasizing the scientific ingenuity of Yantra and Shastra.

DISCUSSION

The historical evolution of Yantra and Shastra illustrates Ayurveda's pioneering role in surgical innovation. *Sushruta Samhita* provided one of the earliest systematic classifications of surgical instruments globally, predating Hippocratic and Galenic writings. This highlights India's leadership in the development of surgical science[16].

When compared with modern instruments, parallels are evident not only in structural design but also in functional principles. The ergonomic emphasis, multipurpose utility, and patient-specific adaptations in Ayurvedic instruments demonstrate a scientific approach to surgery. For instance, *Nadi Yantra* prefigures catheterization, while *Karapatra* resonates with modern orthopedic tools[17].

However, material science has advanced significantly. Modern stainless steel, alloys, and polymers offer greater durability and sterility compared to ancient metals. Moreover, modern surgical instruments benefit from precision manufacturing, enabling minimally invasive procedures beyond the scope of ancient tools[18].

Another critical difference lies in sterilization. While Ayurveda recommended fire, boiling, and herbal fumigation, contemporary surgery employs autoclaving and chemical sterilants to ensure asepsis. Nonetheless, the underlying principle of preventing infection reflects continuity in surgical philosophy[19].

Research gaps persist in systematic comparative analysis of Yantra-Shastra with modern tools. Few experimental archaeology studies reconstruct these instruments to test their practicality. Similarly, museum artifacts remain under-studied. Future research should integrate archaeology, metallurgy, surgical anthropology, and biomedical engineering to contextualize Ayurveda's surgical contributions.

Importantly, acknowledging Ayurveda's surgical heritage does not imply retrograde adoption but offers inspiration for innovation. Ancient ergonomic designs could inspire modern surgical instrument development, particularly for resource-limited settings where simple, multipurpose instruments may be valuable[20].

Thus, Ayurveda's Yantra and Shastra provide not only historical pride but also practical insights into sustainable, adaptable surgical practices.

CONCLUSION

The evolution of Yantra and Shastra in Ayurveda

highlights the advanced state of surgical science in ancient India. *Sushruta Samhita* presented a meticulously classified and functionally diverse set of instruments, many of which parallel modern surgical tools. The emphasis on precision, ergonomics, sterilization, and patient-specific application reflects scientific reasoning well ahead of its time.

Modern evidence demonstrates striking similarities between classical instruments and contemporary scalpels, forceps, probes, catheters, and saws. The dissemination of these ideas beyond India into Greco-Arabic and European traditions underscores Ayurveda's global impact on surgical development.

While modern materials and sterilization techniques surpass ancient practices, the underlying surgical principles remain relevant. The study of Yantra and Shastra provides valuable insights for medical historians, surgeons, and biomedical engineers. Integrating this heritage into modern scholarship fosters cultural pride and scientific inquiry, while also inspiring innovation in instrument design.

In conclusion, the historical evolution of surgical instruments in Ayurveda is not merely of antiquarian interest but a testament to India's enduring contribution to world surgery. Further interdisciplinary research is required to preserve, analyze, and re-contextualize this heritage for contemporary relevance.

REFERENCES

1. Shastri AD. *Sushruta Samhita*. Varanasi: Chaukhamba Sanskrit Sansthan; 2012.
2. Sharma PV. *Charaka Samhita*. Varanasi: Chaukhamba Orientalia; 2014.
3. Murthy KRS. *Ashtanga Hridaya*. Varanasi: Chaukhamba Krishnadas Academy; 2015.
4. Bhishagratna KL. *An English Translation of the Sushruta Samhita*. Calcutta: Bose; 1907.
5. Zysk KG. *Asceticism and Healing in Ancient India: Medicine in the Buddhist Monastery*. New York: Oxford University Press; 1991.
6. Dwivedi RR. Sushruta—the father of surgery. *Indian J Surg*. 2007;69(5):233–236.
7. Majno G. The healing hand: Man and wound in the ancient world. Cambridge: Harvard University Press; 1975.
8. Shah RK. Surgical instruments in Sushruta Samhita. *Bull Indian Inst Hist Med Hyderabad*. 1992;22(1):1–11.
9. Kurek M, Łukaszewicz M. Comparative analysis of surgical instruments in ancient India and Greece. *Hist Sci Med*. 2016;51(3):245–259.
10. Wujastyk D. *The Roots of Ayurveda*. London: Penguin; 2003.
11. Jain S, Singh R. Evolution of surgical instruments: an Ayurvedic perspective. *AYU*. 2014;35(3):345–351.
12. Rai A, Patgiri BJ, Prajapati PK. Surgical heritage of Ayurveda and its relevance. *J Res Ayurveda Siddha*. 2011;32(2):67–74.
13. Meulenbeld GJ. *A History of Indian Medical Literature*. Groningen: Egbert Forsten; 1999.
14. White C. Transmission of surgical knowledge from India to the West. *Med Hist*. 2001;45(3):335–356.
15. Filliozat J. *The Classical Doctrine of Indian Medicine*. Delhi: Munshiram Manoharlal; 2004.
16. Basham AL. *The Wonder That Was India*. London: Sidgwick & Jackson; 1954.
17. Thakur R. Museum evidence of ancient Indian surgical tools. *Indian J Hist Sci*. 2010;45(2):221–232.
18. Tripathi JS. Relevance of Sushruta's surgical instruments in modern surgery. *Anc Sci Life*. 2012;31(4):167–172.
19. Banerjee G. Influence of Sushruta Samhita on Arabic surgery. *Saudi Med J*. 2006;27(12):1811–1816.
20. Acharya VY. Reflections on Shalya Tantra in Ayurveda. *AYUSH*. 2015;32(1):22–30.