

Sushruta: The Father of Indian Surgical History

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Summary: Sushruta, an ancient surgeon from 600 BCE in Kashi, India, is a pioneering figure in medical history. His innovations in surgical techniques, predating Hippocrates and Galen, have left an indelible mark in the field. This review article focuses on Sushruta's contributions to surgery, particularly his foundational work in plastic and reconstructive procedures. We delve into the *Sushruta Samhita*, the oldest surgical text, covering essential principles, pathology, anatomy, and surgical management. Sushruta's approach emphasized cleanliness, cadaver dissection, and innovative practices in anesthesia. Our article underscores the enduring impact of Sushruta's work on modern surgical science. (*Plast Reconstr Surg Glob Open* 2024; 12:e5715; doi: [10.1097/GOX.0000000000005715](https://doi.org/10.1097/GOX.0000000000005715); Published online 5 April 2024.)

INTRODUCTION

Sushruta, a distinguished surgeon who flourished around 600 BCE in the ancient city of Kashi, India, holds a significant place in the history of medicine.¹ Often recognized as a trailblazer, his teachings and innovations in the field of surgery were groundbreaking, with far-reaching effects on the development and advancement of surgical techniques globally.¹ Long before the renowned figures of Hippocrates, Celsius, and Galen, Sushruta was already making remarkable advancements in the field of surgery.^{2,3} He pioneered highly sophisticated procedures that were far ahead of their time, including nose reconstruction using cheek flaps, repair of cut earlobes, piercing of earlobes, repair of cut lips, and the utilization of skin grafting techniques.^{2,3} Notably, Sushruta accomplished these procedures using instruments that he crafted, highlighting his ingenuity and resourcefulness in an era that predates later technological advancements.^{2,3} For his contributions, he is often referred to as “the father of plastic surgery.”

During his tenure as a teacher of medicine at Benares University, he not only imparted his wisdom but also established the original code of medical ethics.⁴ He

emphasized the importance of comprehensive physical examinations using all senses, encouraging his medical students to adopt a thorough approach.⁴ In addition to his surgical expertise, Sushruta demonstrated remarkable insights into the pathogenesis of diseases.⁵ His descriptions of 1120 specific disease entities showcase his deep understanding of various medical conditions.⁵ He was the first to attribute malaria to mosquitoes and link the spread of plague to rats.⁶ Furthermore, Sushruta made an early diagnosis of diabetes by tasting the urine of affected individuals and describing it as having a sweet taste similar to honey.⁶ Sushruta detailed 101 blunt instruments and 20 sharp instruments, emphasizing the fine edge required for their use.⁷ His teachings covered eight fundamental types of surgical procedures, which included extraction, excision, incision, probing, scarifying, suturing, puncturing, and fluid evacuation.⁷ Remarkably, these techniques were taught using household objects and materials, showcasing Sushruta's resourcefulness in a practical setting.⁷

The significance of Sushruta's contributions cannot be overstated. His pioneering work in surgery, particularly in the realm of reconstructive procedures, set the stage for future advancements in the field. The intricate nose reconstruction using cheek flaps and other innovative techniques developed by Sushruta laid the foundation for modern plastic surgery.^{2,3} These techniques, along with his meticulous descriptions and surgical instrumentations, were centuries ahead of their time (Fig. 1).

In this article, we aim to delve into the remarkable surgical methods and innovations of Sushruta in key areas like plastic surgery and reconstructive techniques. We will explore the intricacies of Sushruta's approach to surgical practices; highlight his meticulous teachings, their impact on the development of surgical science and, the profound social implications of Sushruta's work, particularly in addressing disfigurement and its effects on

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Fig. 1. Statue of Sushruta, in Patanjali Yogpeeth, Haridwar, India.⁸

individuals and society; and discuss the enduring influence and legacy of Sushruta's techniques, shedding light on their continued relevance and significance in the field of surgery. By delving into these aspects, we aim to provide a comprehensive understanding of Sushruta's contributions to surgical history and their lasting impact on medical practices.

SUSHRUTA'S SURGICAL METHODS AND INNOVATIONS

Sushruta Samhita

Sushruta's monumental thesis, the *Sushruta Samhita*, stands as the oldest known surgical text, providing a comprehensive exploration of medical practices during his time.⁹ Divided into six principal sections, it covers essential principles, pathology, human anatomy, medical and surgical management, and toxicology.² The text provides detailed descriptions of surgical techniques, including incisions, extractions, cauterization, and various complex procedures such as prostate gland removal, hernia surgery, and cesarean section.¹⁰ Additionally, the *Sushruta Samhita* offers a wealth of knowledge on dislocations, fractures, and the classification of bones, as well as principles of fracture management, traction, manipulation, and stabilization.¹⁰ The text also provides insights into the study of the human body's sequential development, embryology, and even the fitting of prosthetics.¹⁰ Furthermore, the *Sushruta Samhita* contains an extensive compendium of 1120 illnesses, 700 medicinal plants, and preparations derived from minerals and animal sources.¹⁰

Takeaways

Question: This article addresses the lack of awareness and understanding of the significant contributions made by Sushruta, an ancient Indian surgeon, to the field of medicine, particularly in the areas of plastic surgery and surgical practice.

Findings: This article explores the pioneering contributions of Sushruta to the field of medicine, particularly focusing on his groundbreaking advancements in plastic and reconstructive surgery, underscoring his enduring influence on modern surgical practices.

Meaning: Sushruta was a pioneer and possibly the father of modern surgery; his techniques in plastic and reconstructive surgery, his emphasis on cleanliness and anesthesia, and his enduring legacy in shaping modern surgical practices are nothing short of marvelous.

Surgical procedures according to Sushruta are classified into eight types. These include *chedya* (excision), *lekhyā* (scarification), *vedhya* (puncturing), *esya* (exploration), *ahrya* (extraction), *vsraya* (evacuation), and *siyya* (suturing).¹¹

Sushruta's Techniques for Various Surgical Procedures in Plastic Surgery

Recording of disfigurement as a form of punishment dates back to the Vedic period in India, when the Ramayana poem narrated the nasal amputation of the Sri Lankan princess Soorpanakha, as a punishment from the then prince of India Lakshmana, for seducing his brother Rama. The poem continues to narrate how the royal physicians were ordered by the princess's brother king to surgically correct the defect.

India, unfortunately, is rich with a history of nasal amputations, in 1767 the Gurka king ordered mass nasal amputation of 865 male individuals from the land of Kirtipur after defeating the valley following several tries. This gave the town the name "Naskatapoor" (city without noses).¹² The latest nasal amputation was reported in 2010 *Time Magazine* when a young woman named Bibi Aisha was caught after trying to flee from her husband and, as a punishment, suffered nose and ear amputations.¹² Nasal amputation as a form of punishment continues in modern times; in 1889, it was stated by Shah Tribowandas that a nasal amputation is a ruthless form of requital, as the nose is seen not only as a mere organ on the face but also represents an organ of respect and reputation.¹²

Sushruta has intricately documented the surgical procedure of rhinoplasty. He starts with a leaf or creeper with the same dimensions as the defect.^{12,13} This sampled leaf cut out is used as a template to slice a patch of skin, matching its dimensions from the region of the cheek. The slicing followed a cauda-cranial direction, with some regions of the flesh still attached to the cheek.^{12,13} After proper scarification of the margins with a knife, the graft is attached to the severed nose.^{12,13} The wound is covered with cotton and pure sesame seeds, and the nostrils are kept patent with hollow tubes or reeds, which also help respiration.^{12,13}

Sushruta's rhinoplasty method was passed, albeit secretly, through generations in some families in India and Nepal. The Kanghiari family of Khanga practiced the art up until 1440, with a proper patient registry and signed consents. The secret was tightly kept by training only the sons and daughters-in-law and denying unmarried daughters the art. During these times, the procedure was modified from a cheek flap to a forehead flap, and how or when this happened is not clear.¹²

Sushruta's rhinoplasty procedure was translated into Arabic, named "the Indian method," and spread to Arabian lands, including Persia. In the 1400s the procedure made its way to Sicily of Italy, where a modified pedicled arm flap known as the "Italian method" was founded by Branca De Branca. One of the complications of the Italian method according to Branca was that the flaps grew hair and were intolerant to cold weather.¹² In the Samhita, Sushruta has explained in great detail the multiple uses of skin grafts and flap procedures for facial abnormalities. Sliding flaps, rotation flaps, and pedicle grafts are some of the most notable procedures.^{12,14}

SUSHRUTA'S APPROACH TO SURGICAL PRACTICES

Emphasis on Cleanliness, Sanitation, and Sterilization in Surgical Operations

Sushruta Samhita, Sushruta's ancient Indian scripture, is organized into six *sthanas*, or divisions, each focused on a distinct aspect. The Sutra Sthana is the first segment, and it largely deals with broad surgical principles. The Sutra Sthana teaches asepsis principles such as the necessity of cleanliness, sterilization, and maintaining a sanitized surgical environment. It also looks into the techniques and methods used in surgical procedures such as wound closure, suturing, and bandaging.¹⁵ Sushruta also emphasized the importance of using sterile, high-quality tools when performing surgical procedures. According to his instructions, surgical instruments should be constructed of metals like copper, iron, or gold and should be well-cleaned. The tools should be the right sizes, have pointed edges, be made of strong material, and have handles that are easy to use.¹ In [Figure 2](#), we present some of the tools used by Sushruta, published in the English translation of *Sushruta Samhita*.⁷

In addition to the crafting of instruments, Sushruta emphasized the tempering of surgical instruments using substances like caustics/alkalis, water, or oil. This tempering process aimed to maintain them in a good condition, preserving their functionality and reducing the risk of contamination during surgery.¹⁵ Sushruta's instructions included aseptic procedures for operating rooms and recovery areas. He emphasized the value of Dhoopana, or fumigation, an Ayurvedic practice that uses plants that have antiviral and antibacterial qualities. Sushruta advised using herbs like guggulu, vacha, white mustard, saindhava (rock salt), and nimba tree leaves to fumigate the operating room, labor ward, and postoperative ward.¹⁵ He recommended sterilization using substances like salt, mustard, and clarified butter, which can be considered one of the earliest forms of

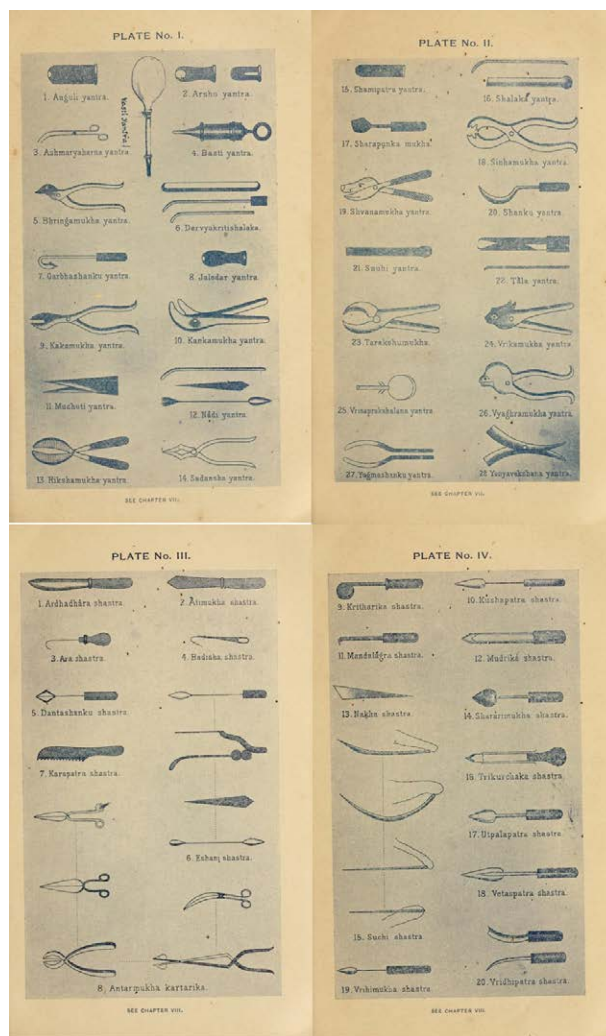


Fig. 2. Some of the tools used by Sushruta that are published in the English translation of *Sushruta Samhita* in four plates.⁷

antisepsis.¹⁶ His use of this technique showed that he was aware of the detrimental impact of germs and the requirement for disinfection in medical settings.

Sushruta's ancient Ayurvedic fumigation methods have demonstrated beneficial effects in eliminating airborne germs and disinfecting inanimate objects. This shows that there is a significant potential for herbal fumigation techniques to address the issue of nosocomial infections.

Sushruta's Teachings on the Importance of Anatomy, Practical Surgery, and Cadaver Dissection

Sushruta emphasized the significance of understanding the anatomy of human cadavers in contrast to the Code of Manu, the Indian system of law, which regarded the deceased corpse as sacred. Dissecting corpses was deemed taboo in many ancient and medieval cultures due to religious or societal beliefs during that time.¹⁵ Sushruta's approach to cadaver dissection was unique. He primarily focused on dissecting the bodies of infants under the age of two, as other corpses were typically cremated, making them unavailable for anatomical study.¹

The cadavers were carefully prepared by wrapping them in grass and submerging them in river water for 7 days. This process facilitated the decomposition of the tissues, enabling Sushruta and his students to study the structural details of the human body layer by layer.¹⁷ The combination of theoretical and practical expertise in surgical education was a focus for Sushruta as a teacher. He created hands-on activities and teaching methods that allowed his pupils to simulate surgery. These models substituted for human anatomical structures by using carcasses, maybe from other animals, and even vegetables to simulate surgical procedures like suturing and puncturing.¹⁸ For instance, incisions were practiced on vegetables, like Pushpafala (*Cucurbita maxima*), Alavu (*Longenaris vulgaris*), or Frapusha (*Cuemis pubescuas*; squash and cucumbers), and evacuation process on leather bags full of water and the urinary bladders of dead animals. Scarification, a technique involving superficial cutting, was performed on animal hides. Venesection was practiced on vessels taken from deceased animals or the stalks of water lilies. Sushruta taught the art of stuffing and probing using bamboo reeds and demonstrated the extraction of solid objects using fruits like Panasa (*Artocarpus integrifolia*) and similar varieties. Scraping techniques were practiced on tax (a type of resin) spread on a plank made of Shalmali wood (*Bombax malabaricum*), whereas suturing exercises were conducted on pieces of cloth, skin, or hides.

Ligaturing and bandaging skills were practiced on dummies, and both actual and potential cauterization techniques were performed on pieces of flesh. Finally, catheterization procedures were practiced using unbaked earthen vessels filled with water. With the aid of these simulated training techniques, Sushruta's trainees were able to gain practical surgical experience. A bungling surgeon is a public danger, and Sushruta said that "theory without practice is like a one-winged bird that is incapable of flight."⁷

Exploration of Sushruta's Understanding of Anesthesia and Analgesia

The Sutra Sthana also discusses several elements of patient care, including anesthesia, pain management, and the management of problems that may emerge after surgical operations.

The *Sushruta Samhita* recommended using wine and cannabis incense as an anesthetic, which is considered primitive by modern standards but set the bar for combining pain management with difficult surgical procedures.¹⁶ Sushruta listed many soporific and alcoholic concoctions used for anesthesia in the *Sushruta Samhita*, including henbane (*Hyoscyamus niger*) and Indian hemp (*Cannabis indica*). These preparations were likely administered orally or topically to help alleviate pain and provide a degree of sedation during surgical procedures.¹⁹ Sushruta also highlighted the value of feeding the patient and giving them a drink of strong wine before the operation. The patient's strength was maintained by a meal, and the wine's anesthetic effects during the treatment rendered the patient asleep and pain-free. He recommended that patients

should be kept on an empty stomach in cases of artificial or instrumental parturition, ascites, piles, bladder stones, ano-fistulas, and disorders affecting the oral cavity.¹⁵ Sushruta's comprehension of analgesia and anesthetic paved the door for more modern surgical procedures throughout his lifetime. Surgeons were able to perform difficult procedures and enhance patient outcomes by using pain control strategies. Sushruta used techniques that would be viewed as archaic by modern standards, yet they lay the groundwork for the development of anesthesia and analgesia in surgical practice, ultimately promoting the growth and improvement of the field.

INFLUENCE AND LEGACY OF SUSHRUTA'S TECHNIQUES

Tracing the Dissemination of Sushruta's Surgical Techniques over Time

It is certain that Sushruta performed surgery and instructed many students at Benares University on the banks of the Ganges.²⁰ The teachings of Sushruta were transmitted orally by his pupils over two centuries, possibly recorded in writing by different authors, and then assembled into a Samhita (compendium).²¹ The Caliph Mansur (753–274 CE) commissioned the translation of *Sushruta Samhita* into Arabic, also known as *Kitab (Book)-Shaw Shoon-a Hindi* and *Kitab of Susrud*. Ibn Abi Usaybia (1203–1269 CE) completed another translation into Arabic. In turn, Latin translations of those Arabian translations served as the foundation for European medicine up to the seventh century. Over 15 Ayurvedic colleagues from the Institute of Medical Sciences of the same university worked with surgeon Dr. Singhal, a Sushruta scholar, for 14 years, merging their understanding of Sanskrit, English, and contemporary medicine. The English translation of the Bower article is the result of their collaboration.²² In 1976, one of Sushruta's masterpieces, which incorporates the surgical process for the treatment of cataracts, was made public. Singhal started working on it in 1962.²³

Only the Sanskrit language was used to maintain *Sushruta Samhita* for many years. Early in the 19th century, Hessler and Muller published the first European translations of the *Sushruta Samhita* in Latin and German, respectively; Kaviraj Kunja Lal Bhishagratna completed the English translation in three volumes in 1907 in Calcutta. Researchers can learn how his practices and expertise have influenced the evolution of surgical methods over time by tracking the spread of his approaches.^{16,18}

Even though the British spent years in India, they did not know about Indian rhinoplasty until 1793. Although working as surgeons at the British Hospital in Poona in 1793, Mr. James Findlay and Mr. Thomas Crusoe saw the procedure on "Covasjee" and published the specifics in the Madras Gazette. Later, a letter from Mr. Lucas detailing the same procedure on Covasjee was published in *The Gentleman's Magazine*, London, October 1794, as follows: "In the war of 1792, Covasjee, a Mahratta from the caste of the husbandmen, drove a bullock for the English Army. Tipu Sultan took him prisoner and amputated his nose

and one of his hands. Near Seringapatam, he enlisted in the Bombay Army. He was without a nose for approximately a year before a guy from the brickmaker (potter's) caste near Poona fitted him with a new one."³ After seeing the procedure being carried out by an Indian surgeon during the Mysore War in 1792, British doctors working for the East India Company had it published in *The Gentleman's Magazine* of London.¹⁶

Joseph Carpue's Mastery of the "Indian Method" and the First English Rhinoplasty Operation

A letter that was published in *The Gentleman's Magazine* in October 1794 alerted European surgeons to the Indian technique for rhinoplasty using a forehead flap. The restoration of a severed nose by an Indian tilemaker caste member was detailed in great detail and with illustrations. Joseph Constantine Carpue, a surgeon from London who lived from 1764 to 1846, was the first English surgeon to exploit this knowledge. In September 1814 and January 1815, he successfully carried out rhinoplasty using the Indian approach. He then carried out more procedures of the same nature. Thus, although not using the Italian or Tagliacotian method, the potential of restoring missing noses was once more brought to the public's attention.²⁴ "An Account of Two Successful Operations for Restoring a Lost Nose from the Integuments of the Forehead" was published by him in 1816. He claims that the Indian approach "offers such a great improvement over the Taliacotian practice" in this work.²⁵

Sushruta's Impact on the Development of Plastic Surgery and Reconstructive Techniques Globally

The first recorded instance of plastic surgery was nasal repair in ancient India. "Nosemakers" were in high demand at the time due to the nasal amputation practice. In the 1400s, a pedicled arm flap was used in the Italian method of nose reconstruction. *De Curtorum Chirurgia* by Gaspare Tagliacozzi, published in 1597, contains a thorough explanation. Since its introduction to Europe in 1794, the Indian method of a forehead flap has been frequently used as the principal flap for both total and subtotal nose reconstruction.¹²

When we look through the literature that is currently available on plastic surgery, we discover that modern science has also stated that the *Sushruta Samhita* is where we may find the earliest references to plastic surgery. Sushruta detailed many suture materials that are either of plant or animal origin, whereas modern surgeons primarily use artificially manufactured suture materials. This is the only distinction that can be seen. When we look at some of the references for managing major wounds, such as reconstruction of the nose, ear, and lips, we can see that the procedures described by Sushruta are the pioneers in modern sciences as well, as some of these procedures are still being followed exactly as described by Sushruta.²⁶

CONCLUSIONS

Sushruta's pioneering work, comprehensive understanding of surgical practices, and innovative techniques have left an indelible mark in the field of medicine. His

contributions continue to shape the development and advancement of surgical techniques, and his teachings serve as a testament to the enduring relevance of ancient medical knowledge. Sushruta's legacy as the father of plastic surgery and his profound impact on surgical science solidify his place as a trailblazer in the history of medicine.

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DISCLOSURE

The authors have no financial interest to declare in relation to the content of this article.

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