

LETTER TO EDITOR

Sushruta: Foundation for Surgical PracticeSiddharth P. Dubhashi*, Aishwarya Avnish¹¹Department of Surgery, Mahatma Gandhi Medical College and Hospital, Mahatma Gandhi University of Medical Sciences and Technology, Jaipur (Rajasthan) India**Abstract:**

Sushruta was an ancient Indian surgeon (600 B.C.) who resided in Varanasi. The teachings and work of Sushruta is compiled in a treatise called *Sushruta Samhita* (Sushruta's compendium), which is believed to be a part of *Atharvaveda*. It contains 184 chapters, descriptions of 1,120 illnesses, 300 surgical procedures, classification of human surgery in 8 categories, over 120 surgical instruments and around 700 drugs of animal, plant and mineral origin. Sushruta was one of the earliest exponents of surgery as an art and science. Sushruta's principles and teachings took surgery in ancient India to a noteworthy pedestal, making it the Golden Age of Surgery. He is truly the "Father of Surgery" and "Father of Plastic Surgery". It is extremely essential that we put his principles into practice, and preserve the dignity of our noble profession. That would be the ideal tribute to this legendary figure.

Keywords: *Atharvaveda*, Father of Surgery, Father of Plastic Surgery, Sushruta

Introduction:

Sushruta was an ancient Indian surgeon (600B.C.) said to be the son of *Rishi Vishvamitra* as per Mahabharata, resided in Varanasi [1, 2]. In the Sushruta school, the first person to expound Ayurvedic knowledge was *Dhanwantari* (Lord deity of Ayurveda), who taught it to *Divodasa*, who, in turn, taught it to *Sushruta*, *Aupadhenava*, *Aurabhra*, *Paushakalavata*, *Gopurarakshita* and *Bhoja* [3]. The Vedic period in the Indian history denotes the compilation of the four Vedas: *the Rigveda*, *the Samaveda*, *the Yajurveda* and *the*

Atharvaveda. The teachings and work of Sushruta is compiled in a treatise called *Sushruta Samhita* (Sushruta's compendium), which is believed to be a part of *Atharvaveda*. Sushruta was one of the earliest exponents of surgery as an art and science. He believed that the knowledge of both Surgery and Medicine are essential to constitute a good doctor who otherwise "is like a bird with only one wing." [4].

Sushruta Samhita:

The *Sushruta Samhita* was written in the holy city of *Banaras (Varanasi)* sometimes around 1000B.C. It is an ancient Sanskrit text on medicine and one of the foundational texts of Ayurveda [4]. Though devoted to the science of Surgery, it also includes salient portions of allied disciplines, thereby truly being an encyclopedia of medical learning [5]. It contains 184 chapters, descriptions of 1,120 illnesses, 300 surgical procedures, classification of human surgery in 8 categories, over 120 surgical instruments and around 700 drugs of animal, plant and mineral origin [4,6].

The *Sushruta Samhita* is divided into two parts: the *Purva-tantra* and *Uttara-tantra*. The two parts together encompass, apart from *Salya* and *Salakya*, other specialties like Medicine, paediatrics, geriatrics, disease of the ear, nose, throat and eye, toxicology, aphrodisiacs and psychiatry. The *Purva-tantra* contains five sections with 120 chapters [4,5]. The sections include:

1. The *Sutra-sthana* (basic principles)
2. The *Nidana-sthana* (aetiology, signs and symptoms of important surgical conditions)
3. The *Sharira-sthana* (rudiments of embryology and human anatomy, along with instructions for venesection, positioning of patient for each vein and protection of vital structures (marma), essentials of obstetrics)
4. The *Kalya-sthana* (Visha-tantra) (nature of poisons and their management)
5. The *Chikitsa-sthana* (principles of management of surgical conditions, including obstetrical emergencies and chapters on geriatrics and aphrodisiacs)

The Uttara-tantra contains four specialties: *Salakya*, *Kaumarabhruthya*, *Kayachikitsa* and *Bhutavidya*. The entire Uttara-tantra has been called *Aupadravika*, with description of complications of surgical procedures as well as fever, dysentery, worm infestation, anaemia, jaundice, etc. The *Salakya-tantra* section of *Uttara-tantra* mentions about diseases of the eye, ear, nose and head [4,5].

Stages of Surgical Procedures

Each surgical procedure is a phased programme of three parts:

- *Purva karma* (pre-operative: patient, operation theatre and surgical instruments)
- *Pradhan Karma* (surgery: eight basic surgical procedures)
- *Pashchat karma* (post-operative: Bandaging, redressing, cleaning, healing, cosmetic surgery)

Despite the surgical bias, Sushruta has advised surgical intervention only in cases of failure of medical management, with stress on importance of proper timing for surgery [7].

Surgical Instruments:

Sushruta described 101 types of blunt (*yantras*) and 20 types of sharp (*shastras*) instruments and their fabrication by different metallic elements, viz. iron and bronze. He also considered the importance of hand as the most important (*Pradhana*) yantra, for without it, no operation can be performed [8]. His system of naming surgical tools after animals or birds they resemble in shape, eg. Crocodile forceps is adapted even today [3]. He laid emphasis on maintenance of sharpness of edges of instruments.

Description of Basic Surgical Procedures:

- 1) *Chedana* (excision): part or whole of limb is cut off from the parent.
- 2) *Bhedana* (incision): made to achieve effective drainage or exposure of underlying structures to let the content out.
- 3) *Lekhana* (scraping / scooping): carried out to remove a growth or flesh of an ulcer
- 4) *Aharana* (extraction): carried out to remove foreign body or tartar of teeth, etc.
- 5) *Vyadhana* (puncturing): drainage of hydrocele or ascetic fluid in abdomen.
- 6) *Esana* (probing): done for sinuses and cavities with foreign bodies.
- 7) *Sravana* (blood-letting): carried out in skin diseases, abscesses, localized swellings, etc.
- 8) *Sivana* (stitching): done in case of accidental injuries and in intentional incisions, wherein lips of the wounds are apposed and united by stitching.

Suturing (materials and needles):

Suture materials were described first by Sushruta. The bark of *Asmantaka* (*Bauhinia racemosa*) trees, silk thread, hair or fibre of *Murva* (*Marsdenia tenacissima*) and *Guduchi* (*Tinospora cordifolia*) were described as suture materials

[7,9]. Suturing needles of different calibres were used: straight, curved and triangular [7].

Bandaging:

Fourteen types of bandages were described: *Kosha* : sheath bandage for fingers and toes; *Dama*: sling; *Swastika*: cross bandage for joints; *Anuvellita*: spiral bandage for extremities; *Muttoli*: winding; *Mandala*: circular; *Sthagika*: stump; *Yamaka*: twin bandage; *Katva*: four-tailed bandage for chin and face; *Cina*: T bandage for perineal wounds; *Vibandha*: employed for trunk; *Vitana*: cephalic bandage; *Gophana*: sling bandage; *Panchangi*: five tailed bandage. The use of cotton to secure the wound from friction during bandaging is the original theme of Sushruta [7].

Dressing and Prevention of Infection:

Sushruta's observations and correct conclusions regarding occurrence of wound infections are indeed noteworthy, as they were made long before Louis Pasteur and Joseph Lister in the nineteenth century dispelled the theory of spontaneous generation of life and established the contagious nature of diseases. He advocated change of dressing at regular intervals (on every 3rd day in winter and daily in summer season) to protect the wound from infection [8].

Wound Healing:

Sushruta has given explicit instructions to clean the wounds of dust, hairs, loose pieces of bones and foreign bodies before suturing to avoid disruption.(7) Classically, *Vrana*(wound) is the exploration of the underlying pathological structure, called as the sixth stage of a continuous process [8]: Stage 1: Inflammation (*Shoatha*), Stage 2: unhealthy wound (*Dusta-vrana*), Stage 3: clean wound (*Shuddha-vrana*), Stage 4: attempt at healing (*Rughyamana-Vrana*), Stage 5: completely healed ulcer (*Rudha-Vrana*). He advocated the use of leeches to keep wounds free of blood clots [4].

Arrest of Haemorrhage:

Sushruta described four methods to stop bleeding: *Sandhana*: involved co-optation of broken edges and ligaturing; *Skandana*: ice was used to lower the temperature, thereby decreasing the blood supply to the part; *Pachana*: use of medicated powders-styptic, which helped the coagulation process; *Dahana*: cauterization of blood vessel to arrest haemorrhage using Kshara (chemicals) or Agni (heat) [7].

Anaesthesia:

Sushruta advocated the use of urine with incense of cannabis for anaesthesia [3,8] Patients were instructed to have food before undergoing minor surgery in order to withstand the pain during operation [5].

Cosmetic Surgical Procedures:

It is an established fact that Indian Plastic Surgery provided the basic pattern for Western efforts in that direction.

Rhinoplasty(*Nasa-Sandhana*)

An article published in Gentleman's Magazine in 1794 in London shows that the *Nasa-Sandhana* was of Indian origin and how it was developed into presently practiced Rhinoplasty [10]Cutting of the nose was a common punishment in ancient India and unique technique of repairing the damage was described by Sushruta [11].Sushruta had taken a green leaf of a tree and trimmed it to as the shape and size of defect of nose. He used the cut leaf to raise the flap of identical dimensions from the side of the cheek. The free end of flap turned towards the nose and apposed on the defect exactly after freshening the defect edges. Two tubes were inserted under the flap to keep the nostrils open. Skin was sprinkled with powder of liquorice and red sandalwood. It was covered with cotton and clean sesame oil was applied.

Sushruta also described Lobuloplasty(*Karna-Sandhana*), repair of cleft lip (*Ostha-Sandhana*), ear puncture(*Karna-Vedhana*)[8] Methods for release of skin for covering small defects, rotation of flaps to make up for partial loss and pedicle flaps have also been described.

Traumatic Wounds:

Sushruta described six types of accidental injuries (*Sadya-Vrana*): *Chinna* (excised); *Bhinna* (incised); *Viddha* (puncture); *Ksata* (lacerated); *Picchita* (crushed); *Ghrista* (abrasion). He mentioned that the removal of foreign bodies is brought with certain complications, if the seat of the *Shala* (arrow) be a *Marma* (Vital spot). Around 100 vital spots have been described by Sushruta, which cause a fatal outcome on injury [8].

Classification of Burns:

Sushruta classified burn injury as *Plusta Dagdha* (singeing), *Durdagdha* (blister formation), *Samyaka Dagdha* (therapeutic) and *Atidagdha* (severe or deep) [8]. He also explained the effect of heat-stroke, sun-stroke, frost-bite due to excessive cold and effect of lightening (*vidyut-dagdha*)[3].

Description of Surgical Techniques:

Sushruta emphasized that the incision should be made in a single stroke with application of appropriate pressure on the knife to keep the edges sharp of the incised tissue. He also described management of hemorrhoids and fistulae. The different types of incisions for excision of fistulous tract include: *Langalaka* (T-shaped), *Ardhalangalaka* (C-shaped), *Savatobhadra* (circular), *Gothirthaka* (half moon) and *Kharjurapatraka* (serrated) [8]. Sushruta has given a description of the anatomy of urinary bladder, varieties of urinary stones, method of extraction and surgical complications [12]. Surgery for intestinal obstruction (*baddha-*

gudodara), intestinal perforation (*chidrodara*), accidental abdominal injuries (*assaya-bhinna*) are also mentioned. Principles of cataract surgery and caesarean section have been established by Sushruta [5].

Orthopaedic Surgery:

Sushruta classified details of six types of dislocations (*Sandhimukta*), twelve varieties of fractures (*kanda-bhagna*), classification of bones and their reaction to injuries, principles of fracture management (traction, manipulation, appositions, stabilization), measures of rehabilitation [13].

Anatomy:

Sushruta's text includes a systemic method for dissection of the human cadaver. He considered that aspiring surgeons must first be an anatomist for skillful and successful practice. He explained the method of preserving the dead body and preparation before dissection [14]. The anatomical study of the human body was carried out even in ancient India. The body was submerged in water and allowed to decompose. An examination of the decomposing body was carried out at intervals to study the structures, layer by layer, as they got exposed following decomposition [15]. Sushruta dealt rudiments of embryology and anatomy of human body together with obstetrics to interpret their clinical relevance [13]. Surgeons of pre-historic India not only had considerable knowledge about various congenital anomalies, but also their treatment [16]. The *Samhita* describes the sequential development of the structures of the foetus. The knowledge of circulation of vital fluids through the human body was known to Sushruta. Arteries were described as channels [17]. He delineated five anatomical divisions of the eye: eyelashes, eyelid, sclera, choroid and pupil. He considered head as the centre of all functions. He gave a detailed description of the cranial nerves [14].

Training of Students:

Sushruta formulated different experimental modules for training in surgical skills. This training plan was called *Yogya* [7]. Various models using natural fruits, dead wood, and clay were used, e.g. incision and excision on vegetables and leather bags filled with mud, scraping on hairy skin of animals, puncturing on vein of dead animals, probing on moth-eaten wood or bamboo, scarification on wooden planks smeared with beeswax [16]. Sushruta Samhita mentions the role of a student in dissection: A pupil, otherwise well-read, but uninitiated, in the practice (of medicine or surgery) is not competent to take in hand the medical and surgical treatment of disease [18].

Sushruta compared theory and practice to the two wheels of a cart. He aptly compared the persons gaining the knowledge only from the books to the warriors who have never been to the battlefield and who run away at the first sight of the enemy. He gave explicit instructions regarding history taking and physical examination of patients. The physical examination included the use of all five senses: inspection, palpation, auscultation, use of taste and smell [7]. He warned that improper interventions due to ignorance regarding disease-process, lack of judgement or greed for money, lead only to complications [3]. He was a teacher par excellence.

Description of Medical Diseases:

Sushruta has provided description of angina pectoris (*Hritshoola*) as chest pain which is precordial, temporary, exertional, emotional, burning like and relieved by rest. He linked it to obesity (*Medoroga*). He described diabetes

(*Madhumeha*) as a disease characterized by passage of large amount of urine, sweet in taste (honey like urine). His advice to resort to physical exercise to prevent diabetes holds true even today. He also elaborated the symptoms of hypertension (*Vatarakta*) [17].

Code of Conduct and Ethics:

Sushruta laid down the principles of code of conduct for practice of surgery. He advocated the requirement of permission from the king before initiating the medical practice which can be compared to registration with Medical Council of India/State Medical Council in today's era. He also elaborated on ethics for teachers and students [5,7].

Frank McDowell described Sushruta as

“Through all of Sushruta's flowery language, incantations and irrelevancies, there shines the unmistakable picture of a great surgeon. Undaunted by his failures, unimpressed by his success, he sought the truth unceasingly and passed it on to those who followed. He attacked disease and deformity definitively, with reasoned and logical methods. When the path did not exist, he made one.” [19].

Conclusion:

Sushruta's principles and teachings took surgery in ancient India to a noteworthy pedestal, making it the Golden Age of Surgery. He is truly the “Father of Surgery” and “Father of Plastic Surgery”. It is extremely essential that we put his principles into practice, and preserve the dignity of our noble profession. That would be the ideal tribute to this legendary figure.

References

1. Singh PB, Rana PS. Banaras region: A Spiritual and culture guide. Varanasi: Indica Books. 2002: 31.
2. Ramamurthy (edited), Ravi. Textbook of Operative Neurosurgery. Delhi: BI Publications Pvt. Ltd. 2005:5.
3. Bhattacharya S. Sushruta-our proud heritage. *Indian J Plast Surg* 2009;42(2):223-225.
4. Saraf S, Parihar R. Sushruta: The First Plastic Surgeon in 600 B.C. *The Internet Journal of Plastic Surgery* 2006;4(2).
5. Singh RK, Vyas MK. Surgical Procedures in Sushruta Samhita. *IJRAP* 2011;2(5):1444-1450.
6. Mukhopadhyaya G. The surgical instruments of the Hindus, with a comparative study of the surgical instruments of Greek, Roman, Arab and the modern European surgeons. Calcutta University Press: Calcutta, 1913:17.
7. Singh LM, Thakral KK, Deshpande PJ. Susruta's contributions to the Fundamentals of Surgery. *IJHS* 1970;5(1):36-50.
8. Bhisagratna KL. An English translation of the Sushruta Samhita. Varanasi: Chowkhamba Sanskrit Series Office; 1963.
9. Sharma PV. Draya Guna Vigyan Chowkhamba Bharati Akadami, Varanasi Ed. 2005;2:699,761.
10. Yogitha EJ, John E. Was Susruta's Nasa-Sandhana developed into Rhinoplasty? *Int J Ayur Pharma Research* 2014;2(1):109-111.
11. Tewari M, Shukla HS. Sushruta: The Father of Indian Surgery. *Ind J Surg* 2005; 67(4):229-230.
12. Das S. Susruta, The Pioneer Urologist of antiquity. *J Urol* 2001; 165:1405-1408.
13. Agarwal DP. Susruta: The Great Surgeon of Yore. http://www.infinityfoundation.com/mandala/t_es_agraw_susruta_frameset.htm. Accessed on 31st January 2016.
14. Deepa B, Pushpalata . Contributions of Sushruta to Anatomy. *Anatomy Journal of Africa* 2014; 3(2):362-365.
15. Prasad A. <http://www.surgerytimes.com/history.html> accessed on 31st January 2016.
16. Raveenthiran V. Knowledge of ancient Hindu Surgeons on Hirschsprung disease: evidence from Sushruta Samhita of Circa 1200-1600 B.C. *Journal of Paediatric Surgery* 2011; 46(11):2204-2208.
17. Dwivedi G, Dwivedi S. Sushruta- the Clinician- the Teacher par excellence. *Ind J Chest Dis Allied Sci* 2007; 49:243-244.
18. Loukas M, Lanteri M, Ferraiola J, Tubbs RS, Maharaja G, Shoja MM, Yadav A, Rao VC. Anatomy in ancient India: A focus on the Sushruta Samhita. *J Anat* 2010; 217:646-650.
19. McDowell F. The source book of plastic surgery. Baltimore: Williams and Wilkins Company 1997; 5-85.

***Author for Correspondence:** Dr. Siddharth P. Dubhashi A2/103, Shivranjan Towers, Someshwarwadi, Pashan, Pune-411008 E-mail: spdubhashi@gmail.com Cell: 988164422