

THE PRINCIPLES OF SURGICAL PRACTICE ACCORDING TO SUSHRUT SAMHITA

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ABSTRACT

Sushrut Samhita is one of the oldest text dedicated to surgery with various techniques and principles mentioned. The *Sushrut Samhita* is a text whose authenticity is questioned a lot due to its repeated translations and revisions yet it is still cited as one of the first and most important pieces of surgical history. The text acts as a bible of surgical practice which establishes basic techniques from suturing to hygiene that is essential for good medical practice. The use of specific named surgical instruments and proper training for surgeons is a precursor to the rigorous training doctor must undergo in current training to ensure an adequate standard of care. Every surgical procedure starts with the creation of a wound and ends up with its healing. Surgical practice has been considered as an art to protect life and health to an acceptable professional standard.

Article Received on
10 January 2024,

Revised on 31 Jan. 2024,
Accepted on 21 Feb. 2024

DOI: 10.20959/wjpr20245-31479



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KEYWORDS: Ayurveda, *Sushrut Samhita*, Surgical Principles.

INTRODUCTION

Surgery is a branch of science /medicine dealing with manual and operative procedure for correction of deformity and defects repair of injuries and diagnosis and area of certain

diseases (taber's D).^[1] Modern basic principles of surgery is given by Dr. Willium stewart hasted (19 th century AD) For attaining worth in surgery with minimal hospital stay and post-operative care, early health recovery and cost affectivity principles as follows.^[2]

- 1) Handle tissue gently.
- 2) Control of haemorrhage carefully.
- 3) Preserve blood supply.
- 4) Observe strict asepsis.
- 5) Minimise tissue tension.
- 6) Appose tissues accurately.
- 7) Eliminate dead space.

There is no doubt that legendary *Acharya Sushruta* and the Indian surgeons of ancient times were well versed with the principles and techniques of surgery.

DISCUSSION

As in the modern surgical principles *Sushrut* has also mentioned the principles of surgery as follows:

- 1) Making good skin incision^[3]

Sushrut has mentioned in Sutrasthan ideal quality of incision as correct technique of incision, correct shape of incision at perticular site, direction of incision, extention of incision, method of suturing and complications of improper incision. Site wise types of the incision are mentioned in the way that it avoid *Marma Sira Snayu* structures beneath the skin with a view to avoid wrong instrumentation. Incisions crossing to Langer's line may be the causative factor for complications like excessive pain, tissue injury and delayed healing and keloid, hypertrophic scar(*manskandi*) formation. The same is narrated in this chapter by *Acharya Sushruta*. In this chapter in context of incision and drainage, it is said to remove the blade from the site of incision as soon as the pus is visible. Concept of re-incision /counter incision is mentioned after this procedure if the pus is not removed by a single incision by incising the skin at a distance of 2-3 fingers. The concept of dependent drainage is given by Acharya as per direction and bulging site.

आयतश्च विशालश्च सुविभक्तो निराश्रयः |

प्राप्तकालकृतश्चापि त्रणः कर्मणि शस्यते ||

यतो यतो गति विद्यादुत्सङ्गो यत्र यत्र

तत्र तत्र त्रणं कुर्याद्यथा दोषो न तिष्ठति ||

भूगण्डशङ्खललाटाक्षिपुष्टौष्ठदन्तवेष्टकाकुक्षिवक्षणेभ्यु तिर्यक् छेद उक्तः ॥
 चन्द्रमण्डलदच्छेदान् पाणिपादेषु कारयेत् । अर्धचन्द्राकृतींश्चापि गुर्दे मदे च बुद्धिमान् ॥
 अन्यथा तु शिरास्नायुच्छेदनम्, अतिमात्रं वेदना, चिरावणसरोही, मांसकन्दीप्रादुर्भावित्वेति ।
 (su. su. 5/11-15)

2) Raktastambhan techniques

Sushrut stated that after incision in surgical procedure or removal of foreign body make sure “nirlohitvam vranam kritva” (making wound blood leakage free) by appropriate measures.^[4] He mentioned several measures for haemostasis like *sandhan* (astringent lotion application), *skandan* (coagulation), *pachan* (chemical cauterisation), *dahan* (thermal cauterisation).^[5] He also mentioned that the foreign materials present in the wound should also be removed before suturing.^[6]

3) Preservation of blood supply^[7]

Proper blood supply is very important in the healing of any wound in this regards Sushrut advocated that surgeon should always kept in mind that do not try for union or suturing where there is no blood supply, impure blood supply, excess blood or inadequate blood supply.

4) Minimal tension of tissue^[8]

The proper approximation of incision site with less or minimal tension facilitating the healing process. Suturing should be done in such a way that it is neither too near nor too far to avoid the cut through and pain respectively. This suturing technique mentioned by the Sushrut.

नातिदूरे निकृष्टे वा सूचीं कर्मणि पातयेत् ।
 दूरादुज्जो व्रणीष्ठस्य सन्निकृष्टेऽवलुचनम् ॥ (su. su. 25/26)

5) Proper skin apposition^[9]

In the Sutrasthan of Sushrut Samhita mentioned that after cleaning the wound raised the edges of wound and brought them into apposition then suture it with fine sutures like horse hair, tendons and plant fibres by continuous suturing technique (*vellitak* suture).

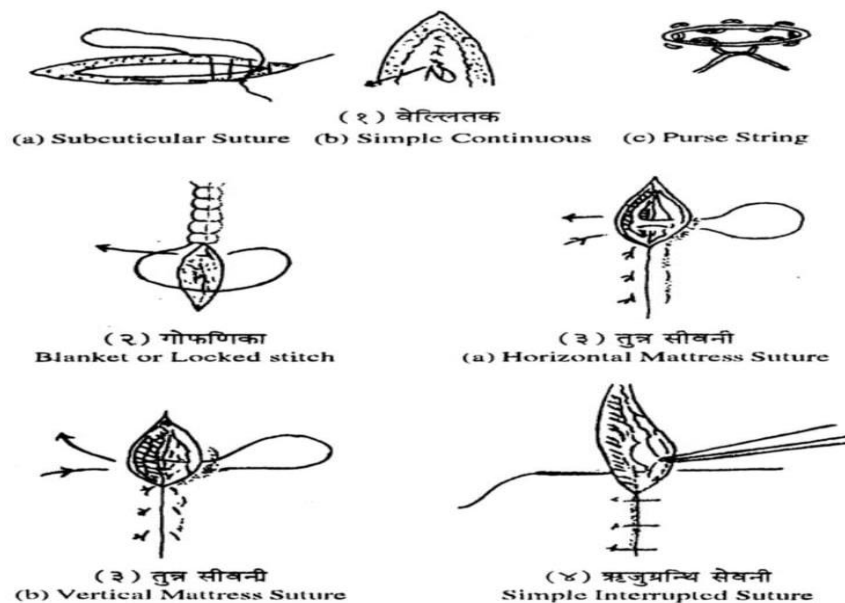
ततो व्रणं समुन्नम्य स्थापयित्वा यथास्थितम् । सीव्येत् सूक्ष्मेण सूत्रेण वल्केनाश्मन्तकस्य वा ॥
 शण्जक्षीमसूत्राभ्यां स्नाय्वा बालेन वा पुनः । मूर्वागुडूचीतानैर्वा सीव्येद्दोऽलितकं शनैः ॥ (su. su. 25/20)

Four types of suturing techniques have been described viz.

- 1) Continuous sutures (*Vellitaka*),
- 2) Blanket sutures (*Gophanika*),

3) Sub-cuticular sutures (*Tunna-sevani*),

4) Interrupted sutures (*Riju-granthi*).



Correct apposition of tissue margins will aid early union of tissue and minimal scar formation.

6) Obliteration of dead space proper cavity closure.

In *Ayurveda* it is a general code that if there is any *Kha Vaigunya* (dead space) it may be a site of pathogenesis and the *kupit doshas* easily attracted to these sites.^[10] It is also mentioned that don't try to heal the wound in hurry as leaving some insipid matters like blood, pus, dead space etc. underneath this can cause recurrence by tiniest disturbance.^[11]

न चैनं त्वरमाणः सान्तदोष रोपयेत् | सात्पेनाप्यपचारेणाभ्यन्तरमुत्सङ्गकृत्वा भूयोऽपि विकरोति || (su. su. 5/38)

7) Strict Aseptic techniques

Surgical asepsis encompasses preparation of instruments, the operating room, the patient, the practitioner the staff. This is why it is recommended to wear caps, masks, gowns and gloves to perform surgery. The smallest mistake in any of these steps may lead to infection, at best it may be incisional infection at worst it can be disastrous when it involves orthopedic implants.

In *sushrut samhita* it is mentioned that before going to perform surgical procedure one should well dressed and cut their hairs, nails etc. To prevent infections always ensured a well planned and well equipped, well arranged *dhoopit* (fumigated) wards and rooms (*vranitogar*) for surgical patients to avoid sepsis.^[12] It prevents the *nishachar* (dangerous and invisible creatures and infectants), *krimi* (worms), flies, dust, direct sunlight, harmful animals etc.^[13]

Concepts of *Dhoopan* (fumigation by drugs in *shalyakarma* is a torch bearing and is indicative

of antiseptic consideration of all parts including wound, bandage material, dressing material bed gowns, surgical wards, rooms etc. constantly practice to avoid commencement of sepsis in wounded patient because it causes destruction of muscles, veins, nerves, etc.^[14] Sushrut has also mentioned a better exposition of aseptic surgery that surgical instruments should be used after *agnitapten* (heated in fire) otherwise risk of suppuration may happen.^[15] On comprehensive study of *sushrut samhita* it can be concluded that sushrut was really the originator of aseptic surgery.

सर्षपाश्चिष्टपत्राभ्यां सर्पिषा तवणेन च ।

द्विरहः काश्येद्वूपं दशगत्रमतन्द्रितः ॥ (su. su. 19/3)

अग्नितप्तेन शस्त्रेण छिन्द्यान्मधुसमायुतम् ॥

बद्ध्वा व्रणं सुजीर्णोऽन्ने सर्पिषः पानमिष्यते (su. chi. 2/46)

8) Six varieties of accidental injuries^[16]

They are described below.

- 1) *Chhinna* - Complete severance of a part or whole of a limb.
- 2) *Bhinna* - Deep injury to some hollow region by a long piercing object.
- 3) *Viddha* - Puncturing a structure without a hollow cavity inside.
- 4) *Kshata* - Uneven injuries with signs of both Chinna and Bhinna i. e., laceration
- 5) *Pichchita* - Crushed injury due to a fall or blow.
- 6) *Ghrista* - Superficial abrasion of the skin.
- 9) Eight disciplines of surgery.^[17]
 1. *Chhedya* (Excision),
 2. *Bhedya* (Incision),
 3. *Lekhya* (Scarification),
 4. *Vedhya* (Puncturing),
 5. *Eshya* (Exploration),
 6. *Aharya* (Extraction),
 7. *Visravya* (Evacuation),
 8. *Sivya* (Suturing).
- 10) Division of Surgical Procedure (*Trividha Karma*).^[18]

Sushruta has proposed the division of surgical procedures into.

- 1) Pre-operative (*Poorva Karma*),
- 2) Main procedure (*Pradhana Karma*),

3) Post operative (*Pashchata Karma*) based on scientific principles.

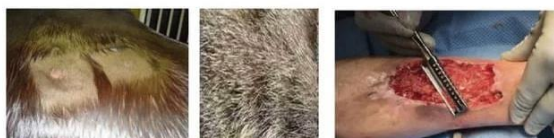
11) Experimental Surgery (*Yogya Vidhi*)

Good knowledge of anatomy (*Sharira Rachna Vigyana*) is a prerequisite for practice of surgery. *Sushruta* was the first to evolve the concept of anatomical dissection on dead bodies (*Shava-vichhedana Karma*)^[19] and the concept of experimental and practical training (*Yogya*) by making use of experimental modules like dummy, parts of dead bodies and different natural objects to gain proficiency in operative surgery. 'Practice leads to perfection' is universal principle advocated by him for all the surgeons of all the times.^[20]

Model: pushpa phala, alabu, kalindaka, trapusa, kushmanda, Ervaruka, karkaruka,



Model: Dead animal skin with hair or animal skin with warty transformations as seen over joints.



Model: On worm eaten hollow pieces of dry wood, Bamboo stem, Dried Alabu.



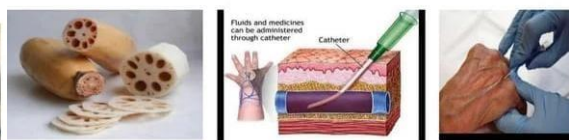
Model: bimbi, bilva, Jack fruit, teeth of the dead animals.



Model: water filled leather bag and bladder of the animals filled with mud or materials of various consistencies.



Model: Vessels of dead animal, lotus stem.



Model: Tying bandages round the specific limbs and parts of dummies.



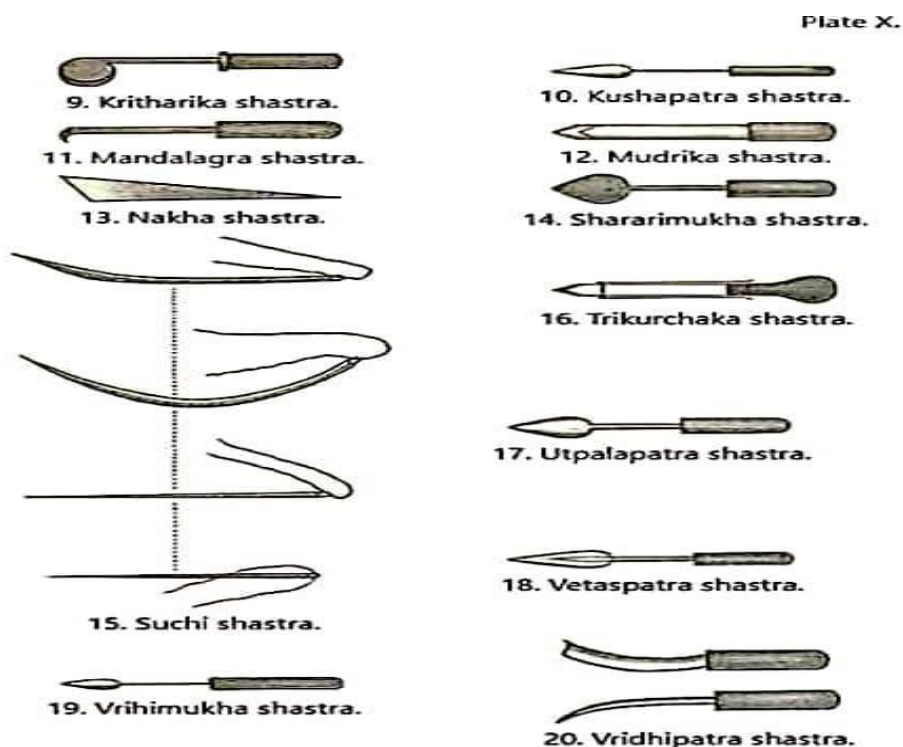
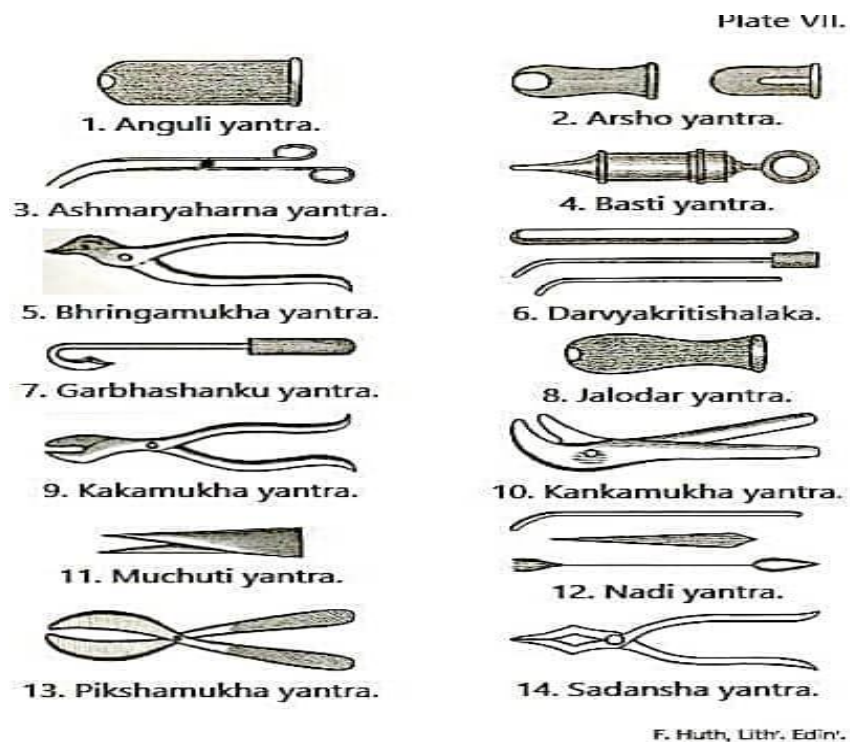
Model: Pitcher containing water with lateral opening, Alabu.



12) Description of Surgical Instruments (*Yantra & Shastra*)^[21]

Surgery is an artwork performed by a surgeon with surgical instruments. Fabrication of surgical instruments both for diagnostic and therapeutic purposes is a magnificent contribution by *Sushruta*. A detailed description of surgical instruments, 101 types of blunt instruments (*yantra*) and 20 types of sharp instruments (*shastra*), their characteristics, uses, technique of holding, storage (*Shastra Kosha*) along with methods of maintenance of edges

etc. are the remarkable contributions. He also considered the importance of hand as the most important (*Pradhana*)yantra, for without it, no operation can be performed. His system of naming surgical tools after animals or birds they resemble in shape, eg. Crocodile forceps is adapted even today. He laid emphasis on maintainence of sharpness of edges of instruments.





13) Surgical Ethics and Consent

Acharya Sushruta has outlined the ethical aspects and conduct of surgeons. The reference of seeking permission from the king prior to entry to do the medical practice reflects the existence of regulatory body in those times.^[22] Reference of obtaining consent prior to the operation is available in 'Ashmari chikitsa' and 'Modhagarbha chikitsa prakarana'.^[23] Description regarding ethics as available in *Sushruta Samhita* is a milestone to guide the surgeons of modern times as well. The patient might suspect his own mother; father, sons or relatives but reposes faith in the physician and submits himself to him (the physician) and does not suspect him. Hence the physician should protect the patient like his own son.^[23]

मातरं पितरं पुत्रान् बान्धवानपि चातुरः ।

अप्येतानभिश्ङ्केत वैद्ये विश्वासमिति च ॥

विस्मृत्यात्मनाऽऽत्मानं न चैनं परिश्ङ्कते ।

तस्मात् पुत्रवदेवेन पालयेदातुरं भिषक् ॥(su. su. 7/29)

14) Bandaging Techniques (*Bandhana Karma*)

There are fourteen types of bandaging techniques described by Acharya Sushruta that are capable of covering almost every part of the body. These are named as follows.^[24]

Kosha Bandha (for thumb and fingers), *Dama Bandha* (sling bandage), *Swastika Bandha* (spica bandage for joints, intermediary region of eye brows and breasts, palms, soles ears), *Anuvellita Bandha* (spiral bandage for extremities), *Muttoli Bandha* (winding bandage for cervical region and penis), *Mandala Bandha* (circular bandage for round parts of body), *Sthagika Bandha* (stump bandage for dressing of tip of thumb, fingers and penis), *Yamaka Bandha* (twin bandage for double wounds), *Khatva Bandha* (four tailed bandage for jaw, temporal region, cheek), *Cheena Bandha* (eye bandage for eye corners), *Vibandha Bandha* (multi-tailed bandage for wounds of back, abdomen, chest), *Vitana Bandha* (cephalic bandage, bandage for head), *Gophana Bandha* (T- bandage for chin, nose, lips, shoulders, pelvis), *Panchangi Bandha* (five tailed bandage for supraclavicular region). He has also described the technique of tying of bandage (*Yantrana*). Knot of the tie should never be placed on the wound as it will cause pain, delayed healing and inconvenience.



15) Use of Anesthesia^[25]

The use of Anaesthesia in the *Sushruta Samhita* is essential in allowing the growth of surgical techniques. With the adequate control of pain, surgeries could become longer and more

complex and are no longer restricted to simple amputations and external growth removals. The *Sushruta Samhita* advocates the use of wine with incense of cannabis for anaesthesia.

16) Recommendation of Food^[26]

Owing to the resultant complications, the concept of 'Nil per oral' prior to surgical intervention should be strictly followed. The concept of eating prior to procedure (*Praka Bhukta*) in minor interventions and empty stomach (*Abhukta*) in major surgeries like *Mudhagarbha*, *Udar-rog*, *Arsha*, *Ashmari*, *Bhagandar*, *Mukhroga* carry scientific basis- to make the patient tolerant for the pain of procedure and to check vomiting and related complications respectively.

प्राक् शस्त्रकर्मणश्चेष्टं भोजयेदातुरं भिषक् । मद्यपं पाययेन्मद्यं तीक्ष्णं यो वेदनाऽसहः

न मूर्च्छत्यन्नसंयोगान्मतः शस्त्रं न बुध्यते । तस्मादवश्यं भोक्तव्यं रोगेषूक्तेषु कर्मणि ||(su. su. 17/12-14)

17) Classification of Burns^[27]

Sushruta classified burn injury as.

- 1) *Plusta Dagdha*(singeing),
- 2) *Durdagdha* (blister formation),
- 3) *Samyaka Dagdha*(therapeutic burn)
- 4) *Atidagdha* (severe or deep).

He also explained the effect of heat-stroke, sun-stroke, frost-bite due to excessive cold and effect of lightening (*vidyut-dagdha*).

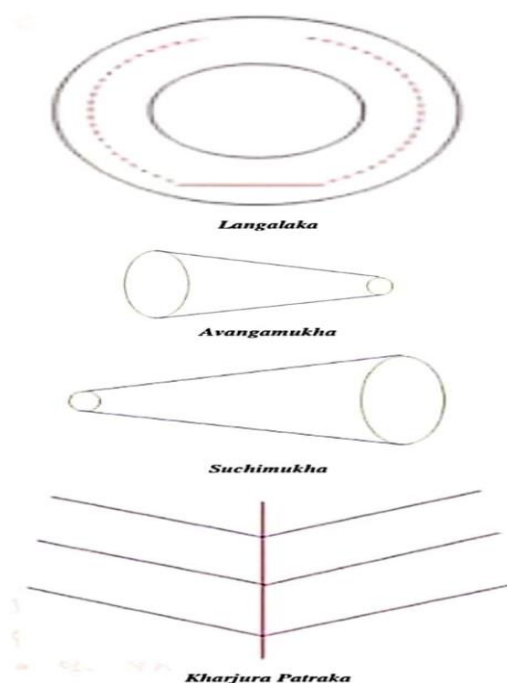
18) Orthopaedic Surgery^[28]

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.

19) 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.^[29] 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).^[30] *Sushruta* has given a description of the anatomy of urinary bladder, varieties of urinary

stones, method of extraction and surgical complications.^[31] Surgery for intestinal obstruction (*Badhha gudodara*), intestinal perforation (*chidrodara*), accidental abdominal injuries (*assaya-bhinna*) are also mentioned.^[32] Out of eight types of *udar rog*, *Badhagudodar* (intestinal obstruction) and *Paristravi udar* (intestinal perforation) are the types where exploratory laprotomy is suggested. In these types of cases Sushruta has advocated to open the abdomen by infraumbilical left paramedian incision. The intestine should be examined properly and obstructing mechanical cause like stone, hair or fecolith should be removed. Intestine should be sutured by *Pippilika dansh* (bite of an ant). A special ant is allowed to bite at two edges of intestine and head is broken from rest of the body. Jaws of an ant remain close, Intestine should be smeared with ghee and honey and deposited back in abdominal cavity. External wound should be sutured. Similarly in *Paristravi Udar* (perforation) *Pippilika bandh* is to be applied rest procedure to be done as explained in *Badhagudodar*. Principles of cataract surgery and caesarean section have been established by *Sushruta*.^[33]



Types of incisions taken in surgery of fistula.

20) 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. 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.^[34] *Sushruta* dealt rudiments of embryology and anatomy of human body together with obstetrics to interpret their clinical relevance. Surgeons of pre-historic India not only had considerable knowledge about various congenital anomalies, but also their treatment. 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. He delineated five anatomical divisions of the eye as eyelashes, eyelid, sclera, choroid and pupil. He considered head as the centre of all functions.

20) Cosmetic Surgical Procedures.^[35]

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. Cutting of the nose was a common punishment in ancient India and unique technique of repairing the damage was described by *Sushruta*. *Sushrut* 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. *Kamalnaal* (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.

21) Dressing and Prevention of Infection.^[36]

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.

22) Suturing (materials and needles).^[37]

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

23) Concept of Revision Surgery.^[38]

To achieve the desired outcomes, sometimes surgical intervention has to be performed in steps specially when corrective surgeries are executed. Revered *Acharya Sushruta* has advocated the basic concept of revision surgery in the context of Rhinoplasty (*Nasa sandhan*).

24) Qualities of good surgeon.^[39]

The definition of an ideal surgeon according to the great surgeon *Sushruta* is “A person who possesses courage and presence of mind, a hand free from perspiration, tremor less grip of sharp and good instruments and who carries his operations to the success and advantage of his patient who has entrusted his life to the surgeon.

शौर्यमाशुक्रिया शस्त्रतैक्षण्यमस्वेदवेपथु

असम्मोहश्च वैद्यस्य शस्त्रकर्मणि शस्यते ||(su. su. 5/10)

25) Concept of foreign body^[40]

Shalya is a foreign body and *Pranashta Shalya* is that foreign body which is not visible to the naked eye. These *Shalya* will move inside the body, gets *Ashraya* in different places and produces discomfort. Therefore it should be removed at the earliest. Foreign body can be inert or active. Active foreign bodies are those which causes inflammation and discomfort and hence to be removed at earliest. Some foreign bodies are found to be inert which do not cause any adverse reactions even if it is retained *Sushruta* has highlighted the concept of inert foreign bodies while explaining about *Pranashta Shalya Anaharana* from *Vishalyapranahara Pradesha* and stressed upon *Kanakadi Shalyas* which are inert in nature and thus harmless if retained inside the body. Most of the *Lakshanas* mentioned by *Acharya* can be seen in the clinical features of foreign body mentioned in contemporary texts. *Budhudavathunnatamrudumamsa*, mentioned in *Samanya Lakshana* is compared with proud flesh/ exuberating granulation tissue. *Shalyamarga Anupasamroha* mentioned in *Marmagata* can be compared with retained foreign body delays wound healing. Diagnostic methods mentioned by *Acharya* such as *Eshanya Sarvato Drushta* is now-a-days used as metallic probe to find the foreign body deep in the cavity. Most of the *Nirharanopava* mentioned by *Acharya* are followed now-a-days also like *Vrana Prakshalana* and *Pramarjana*, *Kanta Shalya* & *Anna Grasa Shalva Nirharana* etc. *Acharya* mentioned *Svabhava Nirharana* as *Kaasa*, *Kshavathuete* can be understood as removal of inhaled foreign body by forceful cough and sneezing. *Ayaskanta* mentioned for removal of *Loha* can be seen used now as

removal of intra ocular foreign body by magnet. In *Kanta Shalya Nirharana Acharya* mentioned after inserting *Naadi Yantra* through that insert *Shalaka* to remove *Shalya*, Same is used now-a-days as an overtube to endoscopy for the extraction of sharp foreign body from esophagus. In *Anna Grasa Shalya Acharya* mentioned *Skandhe Mushtina Abhihanyath*, Same is followed for food bolus impaction in children and also he stated if food not removed by above method then ask the patient to drink *Madya* or *Sneha* same followed as intake of fizzy drinks which dislodge foreign body down. When any person had his abdomen filled with water (due to forcible immersion, drowning accidentally or intentionally) he should be held with his head down and his abdomen should be pressed, his body shaken, made to vomit or buried in a heap of ash up to his face.^[41]

उदकपूर्णोदरमवाविशस्समवपीडयेद्गुनीयाद्दामयेद्वा भस्मराशौ वा निखनेदामुखात् ||(su. su. 27/16)

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. *Acharya Sushruta* being a great surgeon of his times, has contributed a lot and has laid down the foundation of modern surgery. Due to plentiful reasons, it is unfortunate that Ayurvedic surgery (*Shalya Tantra*) has almost forgotten and lost its glory. Description in the ancient Ayurvedic literature requires refinement, enhancement, standardization and authentication of Ayurvedic surgical techniques on modern parameters. The number of pathologies requiring surgical management is increasing day by day and so are the expenses. It is the need of the hour that Ayurvedic surgeons should be trained and promoted and their services should be utilised in the areas where modern surgeons show reluctance to serve. Advanced researches and technologies are meant for the welfare of all. *Acharya Sushruta* being a great surgeon of his times has contributed a lot and has laid down the foundation of modern surgery. Due to plentiful reasons, it is unfortunate that Ayurvedic surgery (*Shalya Tantra*) has almost forgotten and lost its glory. Description in the ancient Ayurvedic literature requires refinement, enhancement, standardization and authentication of Ayurvedic surgical techniques on modern parameters.

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