



Cover Page



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## CONTRIBUTION OF ACHARYA SUSHRUT IN SURGERY

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### ABSTRACT

The Sushruta samhita is a representative work of the Dhanwantariya sampradaya (ancient surgical school) of Ayurveda. It is an ancient Ayurvedic text on surgical techniques written by legendary Acharya Sushruta. Acharya Sushruta has a great contribution towards Ayurveda by giving such great literature. His principles, diagnoses and treatment retain their potency and truth even after a couple of millennia. Its importance is all the more great, since it is the only text now available on Shalya Tantra (surgery) most important branch of Ayurveda. It is the most ancient and authoritative document on this branch of medical science not merely of India but also of the whole world. This article has compiled the contributions of this great stalwart to surgery and interprets his perspective towards teaching this subject.

**KEYWORDS:** Ayurveda, Brihatrayee, Sushrut Samhita, Shalyatantra, Father of Surgery.

### INTRODUCTION

There are many Granthas and Samhitas dealing with Ayurveda; among them, Charak Samhita, Sushruta Samhita, and Ashtanga Sangraha are the three main pillars of Ayurveda. Charak Samhita and Ashtanga Samhita mainly deal with medicine knowledge while Sushruta Samhita deals mainly with surgical knowledge.

The ancient surgical science was known as Shalya Tantra. Shalya means broken arrow or a sharp part of a weapon and Tantra means maneuver. Shalya Tantra embraces all processes, aiming at the removal of factors responsible for producing pain or misery to the body or mind. Since warfare was common then, the injuries sustained led to the development of surgery as refined scientific skill. Some complicated surgeries such as cesarean, cataract, artificial limb, fractures, urinary stones plastic surgery, and procedures including pre-and post-operative treatment along with complications written in Sushruta Samhita, which is considered to be a part of Atharva Veda, are surprisingly applicable even in the present time.

Sushruta Samhita is the first and foremost authentic text of Ayurveda in the specialty of surgery written in the holy city of Kashi around 1000BC by Acharya Sushruta who was primarily a surgeon and recognized as The Father of Surgery in the world. Sushruta Samhita mainly deals with management, prevention and treatment of surgical aspect contains the description of both Shalya (surgery) and Shalakyas (E.N.T.). The Sushruta samhita is divided into two parts, first one is known as the Purva-tantra (have total five sections) and the second one is known as the Uttara-tantra. Together, these two parts cover all the other specialties such as the medicine, geriatrics, pediatrics, aphrodisiacs, toxicology diseases of ENT and eye and psychiatry. Hence, The Sushruta samhita is an encyclopedia of the medical learning for doctors with special importance on the Shalya and Shalakyas. Sushruta samhita has passed through the following four stages in its completion.



Cover Page



1. 1<sup>st</sup> stage - Bhagwan Dhanwantari expounding the knowledge of Ayurveda and Vridha  
Sushruta compiled the Sushruta tantra
2. 2<sup>nd</sup> stage - Acharya Sushruta redacting Sushruta tantra
3. 3<sup>rd</sup> stage - Sushruta samhita is again redacted by Acharya Nagarjuna
4. 4<sup>th</sup> stage - Sushruta samhita is again redacted by Acharya Chandrata

### MATERIALS AND METHODS

This is conceptual type of research. All sorts of references had been collected and compiled from various available Ayurvedic classics texts like Sushruta samhita and available commentaries on it. This research article is also searched from various websites related to Sushruta samhita. All matter is analyzed for the discussion and attempt has been made to draw some conclusions. About Acharya Sushruta the word 'Sushruta' indicates, Su - well, and Shruta - informed - that is, 'a well informed or learned person'. Ayurvedic texts present Sushruta as a son of sage Vishvamitra and descendant of Divodasa Dhanwanatari, the king of Kashi a sacred Hindu place located in Northern India. Acharya Sushruta has not mentioned his birth place and proper introduction anywhere in Sushruta samhita which create curiosity among various historical and Ayurvedists. But he quoted south region of India. NATURE AND COMPOSITION OF SUSHRUTA SAMHITA The Sushruta samhita is a huge treatise on ancient Indian medicine. It was written in Sanskrit language. It is a voluminous text composed in both prose and poetry form. Poetry was known to serve as a memory aid. In Sushruta samhita, the total number of prose passages and verses together is 8500 approximately. Sushruta samhita consists of 186 adhyayas (chapters). In Sushruta samhita, Adhyayas are divided into 6 sthana (sections). Each Sthana is further divided into numerous chapters. Arrangement of chapters is as follows –

Arrangements of chapters in Sushruta samhita is as follows

Sr no.	Name of Sthana	total chapters
1	Sutra sthana	46
2	Nidana sthana	16
3	Sharira sthana	10
4	Chikitsa sthana	40
5	Kalpa sthana	08
6	Uttara sthana	66
Total	6 sthana	186 chapters

### CONTENTS AND BRIEF INFORMATION ABOUT EACH STHANA

#### Sutra Sthana

Sushruta samhita starts with Sutra Sthana which deals with various important fundamentals and basic principles of Ayurveda. This Sthana deals with origin of Ayurveda, description of different branches of Ayurveda and its significance Here there is a collection of various important shlokas related to various context are described. This sthana consists of total 46 chapters. There is detail description of various surgical appliances, instruments, their names, shapes, and methods



Cover Page



DOI: <http://ijmer.in.doi./2022/11.01.120.1>

of use are also described. He very beautifully mentioned importance of practical training by performing surgical acts on dummies according to the situation is been nicely explained. Sutra Sthana also deals with topics including preliminary preparations for surgery, various types of instruments essential for surgery, use of kshara (alkalis), agni (fire cauterization), jalouka (leech application), daha karma (cauterization), collection and preservation of medicinal herbs, administration of emetics and purgatives, various types of food substances etc. Over all in section basic principles as such code of conduct of Vaidya, introduction to instruments, their uses, preparation of antiseptic medicines, methods of bandaging, dressings, prognosis and seasonal regimen is mentioned.

### Nidanasthana

This is the second Sthana of Sushruta samhita. This Sthana consists of total 16 dchapters dealing with Nidana (etiology), Samprapti (pathogenesis), Purvarupa (prodromal sign and symptoms), Rupa (Clinical features) and prognosis of the diseases which are major and exclusively important than surgical diseases. In this sthana only 16 diseases are described. They are Vatavyadhi Nidana (Diagnosis of Diseases of nervous system), Arsha Nidana (Diagnosis of ano-rectal diseases), Ashmari Nidana (Diagnosis of renal calculi), Bhagandhara Nidana (Diagnosis of Fistula in ano), Kushtha Nidana (Diagnosis of Leprosy and other skin diseases.), Prameha Nidana (Diagnosis of Diabetes mellitus), Udara Nidana (Diagnosis of Enlargement of abdomen), Mudhagarbha Nidana (Diagnosis of Foetal obstruction), Vidradhi Nidana (Diagnosis of Abscess), Visarpa-Nadi-Stanaroga Nidana (Diagnosis of Erysipeals sinus, ulcer and diseases of breasts), Granthi- Apachi-Arbuda- Galagandha Nidana (Diagnosis of Benign Tumor, Cervical Metastasis, Malignant tumor and cervical lymphadenitis), Vriddhi-Upadansha-Shlipada Nidana (Diagnosis of enlargement of scrotum, Venereal diseases and Filariasis), Kshudra Roga Nidana (Diagnosis of minor diseases), Shukdosha Nidana (Diagnosis of diseases of the penis) Bhagna Nidana (Diagnosis of Fractures and dislocations) and Mukha Roga Nidana (Diagnosis of diseases of Mouth) etc. are covered.

### Sharirasthana

This is the third sthana of Sushruta samhita. It comprises of total 10 chapters. In this sthana, there is a detail description of fundamental and basic concepts of human anatomy, physiology, embryology and genetics. In this sthana instruction for venesection (cutting of veins), the positioning of the patient for each vein in treating various disorders has been anatomically explained. In this section one of the important chapter is about Marma sharir. Marma is the vital part of human body which is important from surgical point of view. Protection of marmas (vital organs) is also mentioned in detail. It also describes nature of human being, nature of mind and causes of diseases. Description of quality of Shukra (semen), fertilization, menstrual cycle, ovulation, have been explained from embryological view. Concept of sex determination, Garbha vriddhi (fetal development), factors responsible for fertility, infertility and factors responsible for quality pregnancy is been described here. Monthly development of the embryo, factors injurious to the growth of embryo and sign of bicardic stage of pregnant woman is also described. Description of organs and parts of the human body is also furnished here. Kaal and akaal mritu (timely and untimely death) and fa ctors responsible for the maintenance of normal span of life is explained in detailed.

### Chikitsasthana

This is the fourth sthana of Sushruta samhita. This Sthana consists of total 40 chapters. In this sthana, treatment of various diseases Such as Vrana (ulcer), Sadyovrana (Sores or wound), Bhagnas (Fractures and dislocations), Arsha (Piles or Haemorrhoids), Ashmari (Urinary calculus), Bhagandhara (Fistula in ano), Kushtha (Diagnosis of Leprosy and other skin



Cover Page



DOI: <http://ijmer.in.doi./2022/11.01.120.1>

diseases.), Prameha (Diagnosis of Diabetes mellitus), Udara (Diagnosis of Enlargement of abdomen) is described in detailed. Kshinabaliya Vajikarana Chikitsa (Aphrodisiac Therapy) and Sarvopaghata Shamniya Rasayana Chikitsa (Rejuvenation Therapy) are also described here. Descriptions and complications of enema therapy, Smoke inhalation, Nasal medications and gargling therapies are also well explained.

### Kalpasthanana

This is the fifth sthana of Sushruta samhita. This Sthana contains total 8 chapters. The Kalpa Sthana is generally known as the Visha tantra which describes the nature of poisons as well as the management. In this Sthana there is a detail description of various types of poisonous foods, drinks, vegetables, minerals and various poisons of animals. Along with this symptoms and poisonous effect along with its treatment is beautifully mentioned in this Sthana. With this there is a wide description of snake bite poisoning, bites of animals like dog, rat or mice, wolf and fox has been described along with its treatment.

### Uttaratantra

Uttara Tantra is 6<sup>th</sup> and the last division of Sushruta Samhita which has not been composed by Acharya Sushruta. It is believed that Uttara Tantra is addition to main treatise contributed by its redactor, Nagarjuna. It deals with various other subjects which were not discussed in the earlier divisions covered in 66 chapters. The Uttara tantra contains the remaining four specialties namely Shalakyia (ENT), Kaumarbhritya (Paediatrics), Kaya Chikitsa (General medicine) and Bhutavidhya. The Uttara tantra is entirely known as the Aupadravika since many complications of surgical procedure as well as Jwara (fever), krimi-roga (worm infestation), pandu (anaemia), Atisara (dysentery), Kasa (cough), kamala (jaundice) etc. are briefly described here. Major description of Shalakyia Tantra is available in Uttara Tantra of Sushruta Samhita and some description in Nidana Sthana and Chikitsa Sthana.

### SPECIAL FEATURES OF SUSHRUTA SAMHITA

Sushruta samhita stands strongly as a representative of one branch of Ayurveda known as Shalya Chikitsa (Surgery). It is composed in poetic format which becomes easy to memorize the quotations.

- Plastic surgery is the unique contribution of Acharya Sushruta for which the whole world is indebted to him.
- Acharya Sushruta has mentioned five types of Asthi (bones). They are Kapala (flat bones), Ruchaka (teeth), Taruna (young), Valaya (curved or irregular bones) and Nalaka (tubular bones)."
- According to Acharya Sushruta, Vaidya (physician), Rogi (patient or sick person) Bhesaja (proper drug) and Paricharak (compounder or nurse) these are the four limbs of treatment and responsible for its success. These four factors equipped with good qualities, will able to cure even a great disease, within a short time.

Acharya Sushruta was very well aware of the Ashmari (urinary stones) and the anatomy of Basti (urinary bladder) along with its relations is well described in the chapter "Ashmarichikitsitopakramah". Along with this variety of stones, their signs and symptoms, the method of extraction and operative complication are given in detail.

Acharya Sushruta emphasizes in his text that he who studies any one science only, will not be able to arrive at a correct decision, hence the physician should be in know of relevant sister branches of sciences.



Cover Page



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According to Sushruta, Shashtra karma (surgical activity) is of eight types. They are Chedyā (incision), Bhedyā (separating), Lekhyā (scraping), Vedhyā (puncturing, piercing), Eshyā (probing), Aaharyā (extracting, pulling out), Visravayā (draining of fluid), Sivayā (suturing, sewing).

Sushruta mentioned five characteristics of ideal Vrana as Aayata (adequate length), Vishal (adequate width), Suvibhaktō (edges separated), Nirashrayā (absence of hollow space inside) and Praptakalakrūtā (at the proper time).

Acharya Sushruta mentioned that intelligent physician should remove the bandage after three days in Hemant (dewy), Shishira (winter season) and Vasanta ritu (spring), and after 2 days in Sharad (autumn), Grishma ritu (summer) and Varsha Ritu (rainy season). "

Acharya Sushruta has elaborately described six types of Sadyovrana (Traumatic Wounds or sores) caused by weapons of variously shaped edges in the different parts of human body. They are (1) Chinna (cut) (2) Bhinna (punctured), (3) Viddha (pierced), (4) Ksata (crushed), (5) Picchita (contused) and (6) Ghrīṣṭa (lacerated).

Acharya Sushruta has elaborately explained about Dagdha vranas (kinds of burns) and classified them into four types like Plushta Dagdha (scorched burn), Durdagdha (blistered burn), Samyak Dagdha (superficial burn) and Atidagdha (severe or deep burn).

This knowledge of the features of these four kinds of burns will be helpful for physician for performing his activities (treatments).

- Acharya Sushruta has also explained the treatment of Dagdha vrana in detail.

Acharya Sushruta has described the features of a healthy person. According to him, Health is in balance when all three doshas (Vata, Pitta and Kapha) are all in equilibrium, Agni (digestive fire) is in a balanced state and the dhatus (tissues) and proper elimination of malas (wastes) are in proper order. When atma (soul), senses and Mana (mind) are also in a Prasanna avastha (pleasant state) Such a person is called a Swastha purusha (healthy person). This definition of Swastha (healthy)' given by Acharya Sushruta is ideal one even today.

- The descriptions of Marmas (vital spots) given elaborately in a separate chapter is unique which has applied importance in surgery. Acharya Sushruta had described 107 Marmas (Vital spots) in the body which causes fatal result when injured. Sometime either sudden death or subsequent permanent deformity of body organ. These Marmas are divided into Mamsa Marma (muscular vital spots), Sira Marma (venous vital spots), Snayu Marma (ligamentous vital spots), Asthi Marma (bony vital spots) and Sandhi Marma (joints vital spots). Acharya Sushruta emphasizes that unless physician possess enough knowledge of relevant sister branches of learning, he cannot able to arrive at a correct decision. Hence the physician should be in known of many sciences.

### Surgical instruments

Acharya Sushruta has described 101 types of Yantras (blunt instruments) and 20 types of Shastras (sharp instruments). The unique classification of surgical instruments as Yantras and Shastras holds good even today. He had also considered the importance of hand as the Pradhana yantra (most important) because without the hand, instruments cannot be used at all. All the functions of the instruments are dependent on hand. 1 • Yantra (blunt surgical instruments) are divided in major six categories. They are-



Cover Page



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### Classification of Yantras

Sr. No	Sanskrit Name	Modern Name	Total no.
1	Swastik yantra	cruciform instruments	24
2	Samdamsha yantra	pincers, forceps etc	2
3	Tala yantra	instruments with flat discs	2
4	Nadi yantra	tubular instruments	20
5	Shalaka yantra	Rods, rod like instruments	28
6	Upayantras	accessory instruments	25

Names of Yantras these are given as per their shapes resembling to the animals, birds etc. e.g., Simhamukha (Lion Forceps), Shararimukha (like Sharari bird -Scissor) etc.

20 Shastra (Sharp Instruments) have been mentioned by Sushruta which are employed in Shastra karma (main operative procedure). These are Mandalagra shastra (round knife, sharp curette), Karpatra (surgical saw), Vridhipatra (bistuar), Nakha (nail), Mudrika (finger knife), Utpalapatra (lanc et), Ardhadhara (curved lancet), Suchi (surgical needles) Kushpatra (long double edged scalpel), Aatimukha (short scissors), Shararimukha (long scissors), Antarmukha (curved lancet), Trikurchaka (brush like sharp spike in three sides), Kutharika (surgical axe), Vrihimukha (trochar), Ara (awl), Vetaspatra (scalpel), Badisha (sharp hooks), Dantashanku (teeth scraper), Eshani (sharp probe).19

#### Quality of ideal Surgeon:

For a successful surgical manoeuvre, the surgeon should have courage, quickness in action, should be non-shaking, non-sweating, (self-confidence and self-command), should have sharp instruments. The qualities are alike as Lion's Heart, Eagle's eyes" Ladies finger, etc. as mentioned in modern era. For acquiring these qualities practical training is very essential and for this purpose a number of models were created to learn the procedures before applying them on humans.

#### Yogya (Practical training)

Sushruta mentions the importance of practical knowledge for a student: A pupil, otherwise well-read, but uninitiated, in the practice (of medicine or surgery) is not competent to take inhand the medical and surgical treatment of disease, So he introduces the student to the primary techniques in surgical practice. All operative manoeuvre involve one or more of the eight varieties of Ashtavidha shastra karma (intervention) – Chedana (excision), Bhedana (incision), Lekhana (scraping), Vyadhana (puncturing), Eshana (probing), Aharana(extraction), Visravana (draining) and Seevan (suturing).

To obtain proficiency, skill and speed in various surgical procedures, Sushruta devised various experimental modules. For example, Bhedana (incision) and Chedana(excision) are to be practised on vegetables and leather bags filled with mud of different densities; Lekhana (scraping) on hairy skin of animals; Vedhana (puncturing) on the vein of dead animals and lotus stalks; Eshana(probing) on motheaten wood or bamboo; scarification on wooden planks smeared with beeswax, etc.



Cover Page



## Methods of Examination and Approach to Diagnosis and Management:

After obtaining practical training students are taken to bedside for examination of the patient. This is called Vishikha or Karma marga, the procedure for the clinical study. Sushruta has given six means for diagnosing a disease– Shrota (auscultation), Sparsha (palpation), Chakshu (inspection), Jihwa (by tasting), Ghrana (by smelling) and Prashna (interrogation). With the help of above means combined with observation and inference, student will be able to decide the Dosha (causative factor) and Dushya (cellular structure) involved in a disease, whether the disease is nija (intrinsic) or Aagantuja (extrinsic) in origin and in what Kriyakala (stage of disease) the disease is, according to this the management will be decided, whether Shodhana or Shaman or Karshana or Brimhana chikitsa is to be applied, whether it needs Shalya karma (surgery), Kshara karma (chemical cauterization) or Agni karma (thermal cauterization).

## Embryology

Sushruta proposed first to embryology and then anatomy of human body; which is an extension of the embryo. He dealt rudiments of embryology and anatomy of human body together with obstetrics to interpret their clinical relevance (Agarwal, 2013). Evidence from Sushruta Samhita indicates that Hindu surgeons of prehistoric India not only had considerable knowledge about various congenital diseases, but also their treatment. (Raveenthiran V 2011). deal with the describes sequential development of the structures of the foetus. Sushruta has mentioned in one of the Samhita the chapters of Sharirastana that the foetus develops seven layers of skin, naming each layer and the specific diseases which may affect that layer in adult life. He was also aware of diseases by genetic inheritance. He mentions many congenital defects acquired from parents and those resulting from indulgences of the mother during pregnancy. Therefore, he advises her to avoid exertion for the perfect development of the foetus (Mukundcharandas, 2005). Developmental and heredity concepts were known to Sushruta. He has given a rudimentary account of human epigenetic development in his book. He also attaches importance to neuroembryology in the Sarira- sthana section. (Singh, 2011). What astonishes much more is the proficiency he accomplished just by mere observation, which is possible in present day only with the aid of investigations and ultrasonography.

## Dissection of Dead body

For a surgeon, anatomical knowledge is the core of his study without which he is like a slaughter. Sushruta was the first person who had established the preservation of deceased and cadaver dissection in scientific manner to learn medical science. He explained the method of preserving the dead body and preparation before dissection. Method of dissection is precisely stated in the text, the same method is being used in a modified way today. Sushruta says anyone desirous of acquiring a thorough knowledge of anatomy should prepare a dead body and carefully observe (by dissecting it) and examine different parts. "For dissecting purposes, a cadaver should be selected which has all parts of the body present, of a person who had not died due to poisoning, not suffered from a chronic disease (before death), had not attained 100 years of age and from which the faecal contents of the intestines have been removed. Such a cadaver, whose all parts are wrapped by any one of Munja (kind of grass – Saccharum munja Roxb.), Valkala (bark – Valeriana hardwicki wall), Kush (kind of grass – Desmostachya bipinnata (L.) etc. and kept inside a cage, should be put in a slowly flowing river and allowed to decompose in a bunlighted area. After proper decomposition for seven nights, the cadaver should be removed (from the cage) and then dissected slowly by rubbing it with the brushes made out of any of Usira (kind of grass – Vetivera zizanoides(linn.), Vala (hairs of tail of animals), Venu (Bambusa arundinaceae wild.) etc".



Cover Page



## 1) Kalaa (Epithelial cell layers):

Sushruta has described 7 types of Kala (cell membrane) which gives rise to further differentiation of various tissues and organs. These are

i) **Mamsadhara kala** – This is connective tissue layer inside muscles e.g., aponeurosis, intermuscular septa.

ii) **Raktadhara kala** – This is thin mucous membrane inside the arteries, vein, liver and spleen.

iii) **Medodhara kala** – These are the membranes composed of adipose tissue such as omentum.

iv) **Shleshmadhara kala** – These are seen in synovial membranes of joints.

v) **Purishdhara kala** – These give rise to mucous membrane of small and large intestine

vi) **Pittadhara kala** – It forms mucous membrane of gall bladder, stomach and duodenum.

vii) **Shukradhara kala** – It gives rise to mucous membrane of testis, seminal vesicles, vas deferens prostate and epididymis in males, uterus, vagina ovaries and fallopian tubes in females.

## 2) Twacha (Skin)

Sushruta gave 7 layers of skin – Avbhasini (Stratum corneum), Lohita (str. lucidum), Sweta (Str. granulosa), Tamra (Str. spinosum), Vedini (papillary layer), Rohini (reticular layer), Mamsdhara (Adipose layer). First 4 form epidermis and last 3 form dermis.

## 3) Ashaya (Internal organs)

7 internal organs have been mentioned in males – Amashaya (stomach), Pakwashaya (intestine), Pittashaya (gall bladder), Vatashaya (large intestine), Shleshmashaya (lungs), Raktashaya (spleen and liver), Mutrashaya (urinary bladder) and extra one in females (8) - Garbhashaya (uterus).

## 4) Dhatu (Body tissue)

7 types of tissue are mentioned – Rasa (nutrient material), Rakta (blood), Mams (muscle), Meda (fatty tissue), Asthi (bones), Majja (bone marrow), Shukra (semen).

## 5) Srotas (External openings)

Sushruta has given 9 srotas in males – Shravana 2 (ear) Nayana 2(eyes), Vadana 1(mouth), Ghrana 2 (nasal openings), Guda 1(anus), Medra 1(penis/urethra) and 3 extra for females - Stana 2 (breast) and Artavaha srotas 1(vaginal).

## 6) Vascular system

The knowledge of circulation of vital fluids through the body was known to Sushrut in 6th century BC itself. He has differentiated the vascular system into vein, artery and lymphatic channels.

### a) Dhamani (Artery)

They are meant for carrying the nutrient material and are 24 in number. All of these arise from Nabhi (umbilicus) - 10 go in upward direction to supply head and neck, 10 go downwards to supply the trunk and lower extremities and the remaining 4 travel transversely to nourish upper extremities.

### b) Sira (Vein)

These are 700 in number and originate from 40 Mula sira (main branches) - 10 for Vata, 10 for Pitta, 10 for Kapha and 10 for Rakta and all 4 further divides into 175 each. Vatawaha sira are pinkish in color and contain nutrient material, Pittawaha are bluish in color and contain bile, Kaphawaha are white in color and contain lymph.



Cover Page



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## 7) Marma (Vital spots)

He described 101 number of Marmas (vital spots) in the body which causes fatal result on injury, either sudden death, haemorrhage or subsequent deformity. The detailed anatomical landmark of each and every Marma was described by Sushruta.

## 8) Netra (Eye)

Sushruta have mentioned 5 Mandalas [Paksham (eye lashes), Vartam (area of eyelids), Sveta (sclera), Krishna (cornea) and Drishti (pupil)], 6 Sandhi (joint, fornices), 6 Patal (layers) of the eye. Netra budbud (eyeball) is 2 Angula (finger breadth) depth, one's own thumb in width, 2 and 1/2 Angula (finger breadth) in circumference.

## 9) Musculo Skeletal System

**i) Pesi (Muscles)** – According to Sushruta there are 500 muscles in the body – 400 in extremities, 34 in head and neck and 66 in trunk. Females have 20 extra muscles according to Sushruta – 5 for each breast, 4 in Apatyapath (passage of fetus), 3 are attached to Griva chidra (mouth of uterus), 3 in Shukraartava praveshani (passage for menstrual blood and entry of semen).

**(ii) Kandara (Tendons)** – 16 tendons have been described – 4 in both Pada (foot) and same number in Hasta (upper extremities), Griva (neck) and Prishtha (back).

**(iii) Snayu (Ligaments)** – Total 900 Snayu are mentioned in the body – 600 in extremities, 230 in trunk and 70 in head-neck. These Snayu are of 4 types according to their size and shape – Pratanvatt (broad), Vritta (round), Prithu (thick and big), Sushir (hollow).

**(iv) Mamsarajju (Muscular fascia)** – They are 4 in number situated on either side of back, 2 lying externally and 2 internally. Their main function is to bind up all the muscles of back.

**(v) Kurcha (Brush like structures)** -These are 6 in number, 2 in hands, 2 in feet, one each in neck and penis.

**(vi) Seevani (Raphe)** – Total 7 sutures are mentioned – 5 in head-forehead, 1 in Shephas (scrotum, below the root of penis), 1 in dorsal surface of tongue.

**(vii) Jala (Networks)** – They are 4 in number, one each of Mamsa, Sira, Snayu and Asthi.

**(viii) Asthi (Bone)** - Sushruta classified bones based on dissections as Kapala (flat bones), Ruchaka asthi (teeth), Taruna asthi (cartilages), Valaya asthi (round bones) and Nalaka asthi (long bones). He gave total 300 bones in the body – 120 in extremities, 117 in the Shroni (pelvis), Parshava (flanks), Prishth (back) and Uras (chest), 63 in head-neck. He has even elaborated the number and place of these bones.

**ix) Sandhi (Joints)** Joints have been classified into 2 – Chala sandhi (movable) and Achala sandhi (fixed). Again, these are classified into 8 types- Kore sandhi (hinge joint), Ullukhala sandhi (ball and socket joint), Samudga sandhi (concave joint), Pratar sandhi (pivot and gliding joint), Tunna sevini (suture), Vayas tunda (crow beak joint), Mandal (Annular joint), Shankhavart sandhi. There is total 210 joints in the body – 68 in Shakha (extremities), 59 in Kosktha(trunk), 83 in head-neck.



Cover Page



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## 10) Trividha Karma (Three Operative procedures)

The trividha karma are nothing but the pre-operative, operative and post-operative procedures, a systematic portrayal of surgery. Whichever the surgical procedure maybe it has the above said three parts in it.

### A) Purvakarma (Pre-Operative)

Pre- operative means not only related to preparation of patient. Sushruta stresses the importance of collecting all the materials needed during the operative procedure and for postoperative care He has given a list of appliances required in surgical operations e.g., Blunt Instruments, Sharp Instruments, Leeches, Cotton, Pieces of Cloth, Thread, Leaves, Materials of Bandaging, Honey, Ghee or Clarified Butter, Suet, Milk, Oils, Decoctions, Cold and Hot Water, Iron Pans and other Earthen Vessels; Beddings and Seats, Obedient, Steady and Strong Servants etc.

### B) Pradhana Karma (Main Operative procedure)

This includes mainly Ashtavidha Shastra karma (Chedana, Bhedana, Lekhana, Vyadhana, Eshana, Aharana, Visravana, Seevan).<sup>10</sup> Almost all surgeries performed today by modern surgeon include these eight techniques of Sushruta. He has given Seevan karma in detail with types of sutures, materials used, type of suturing, how to apply suture etc.

Seevan Karma (Suturing) The threads used may be of silk, cotton, jute, human hair, horse hair, Snayu (tendon), inner bark of tree, tendril etc. The needles may be of straight, round body, straight triangular, curved, half curved, curved triangular etc.

The types of suturing are: Rujugranthi (simple interrupted), Anuvellita (simple continuous), Gophanika (blanket sutures), Tunna sevani (lambart, subcuticular) etc. In surgery how skin suturing should be done to avoid the complication is most important. It Should not be too long from margin otherwise may be painful and should not be too close from margins otherwise they will cut through.

### C) Paschat Karma (Post Operative measures)

After the operative procedure, the patient is to be assured. The operative wound is to be cleaned & dressed with Vikeshika (medicine impregnated pad) or proper medicated oil, emulsion, paste or dusting powder etc. The operative wound portion is to be fumigated with germicidal and air purifier medicines to avoid the pus formation. Raksha karma (protective rites) for patient has been given. The patient is to be kept in Vranitagara (post operative ward) for ten days as mentioned below. Here Sushruta has given do and don'ts for the patient, dietary instructions, proper wound management and medication.

## 11) Vranitagar (Surgical ward)

Sushruta directs that there should be a particular room provided for patients who have Undergone surgical operation. This room should be a clean house, situated in a wholesome locality, free from dirt-sunlight and heavy breeze. The bed of the patients should be soft, spacious, and well-arranged with head towards east and weapons alongside (for protection from enemies, animals etc.). Room should have some affectionate friends/attendants of patient with him. The fumigation of the sickroom with antiseptic preparations such as Ashtanga dhupas should be done.

## 12) Vrana

Sushrut has mentioned two types of wounds i.e., Nija and Aagantuja (accidental injuries) which have their own subtypes and the phases through which a wound goes during its healing. These wounds if neglected become Dushta vrana (contaminated wound) and fail to heal, so to prevent contamination and provide quick wound healing surgeon should understand the nature of Vrana and act accordingly. He has dedicated three chapters of Sutrasthana (chapter 21 to 23) for this purpose. Sushruta has beautifully explained each aspect of Vrana, and its management in two chapters (1-2) of Chikitsa sthana elaborately.



Cover Page



### 13) Bandhana (Bandaging)

A detailed account of utilization of bandages in post operative care of the wound and in fracture management is noteworthy. After Pradhana karma, the area has to be bandaged with or without medicated dressing. It protects the Vrana from flies, dust, cold, windy etc and thus prevent it from becoming infected. Sushruta has given 14 types of bandaging. He explained different materials that can be used for Bandhana, how to bandage, how much pressure it should exert, when to change the bandage and which type of Vrana not to be bandaged. This knowledge is essential for post operative care of Vrana and its proper healing.

### 14) Shalya (Foreign bodies)

At that time the commonest weapon used in wars were arrow, spear, sword etc which used to pierce the body and act as foreign material leading to suffering to the patient. Besides these, stones, seeds, food etc get lodged into orifices like ear, throat and lead to trouble. Shalya means the disease process which brings pain and discomfort in Sharira (body) and Mana (mind) of the patient, Sushruta has given two types of Shalya - Sharirik and Aagantuj shalya (some of which suppurate if left and some get dissolved/absorbed in body), features of Shalya in different dhatus, methods to diagnose these and their management (15 Shalya nirharan upaya – removal of foreign bodies). Features of drowning and its management is also mentioned.

### 15) Agni karma (Thermal cauterization)

Properly carried out Agni karma obviates the recurrence of disease and conditions resistant to medication, Kshara and Shastra karma are curable by Agni karma. Its indications, contraindications, types, shape of Dagdha, features according to site, materials used etc has been described by Sushruta in detail.

### 16) Kshara karma (Chemical/Alkaline cauterization)

It is the most important measure amongst Shastra and Anushastra; it performs excision, incision etc., arrests three Dosha (causative factors). It is of two types -Paniya (internal use) and Pratisarniya (external use) and is manufactured in three strengths – Mridu (mild), Madhyam (moderate) and Teekshana (severe). Its preparation, Guna (properties), Dosha (defective factors), indication, contraindication, technique of utilization, features of proper Kshar karma has been explained in detail.

### 17) Raktamokshana (Bloodletting)

It is very important as it is considered to occupy 50% of entire surgical management. Bloodletting being practiced in world is the contribution of great Sushruta. Two separate chapters (Jalaukavacharan and Siravedha) are devoted for the bloodletting in patients with detailed description of whole procedure, indications, complications, their management etc. Now a day's plastic surgeons are using Jalauka (leech) for proper acceptance of graft. In case of post trauma hematomas and in ischemic cases leech application has been reported very useful.

### 18) Rakta Sandhana (Haemostasis)

Sushruta has given four steps to control excessive bleeding occurring after Siravedhan (puncturing of vein) – Sandhana (joining the edges of the wound by use of astringent drugs), Skandhan (promoting clotting by use of cold), Pachana (styptics by use of ash, alkali etc.) and Dahana (cauterisation). Kashaya (Astringents) unites the wound edges, himm (cold) makes the blood clot, bhasma (ash) adheres there and closes the wound and daah (thermal cauterization) constricts the vessel thereby stopping the bleeding.



Cover Page



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## 19) Shotha (Inflammation)

It is a localized swelling characterized by an augmented size, even or uneven elevation, situated in skin and underlying tissues, having accumulation of Dosha (causative factor), arising in any part of the body and different from Granthi (cyst/lipoma), Vidradhi (abscess) and Alji (cervical lymphadenitis). It is of 6 types depending on Dosha (Vataja, Pittaja, Shleshmaja, Sannipataja, Shonitaja) and Aagantuja and has 3 stages – Aam, Pachyaman and Pakva shotha. Sushruta even gave its pathogenesis - without Vata there is no Ruja (pain), without Pitta there is no Paka (ripening), without Kapha there is no Puya (pus); hence during the stage of ripening of Shotha all doshas are involved. Vitiated Pitta, takes control of Vata-Kapha and causes ripening of Rakta, this is the second opinion. Sushruta has given the 7 principles of its management – Vimlapana (softening by kneading with fingers), Avsechana (bloodletting), Upnaha (warm poultice), Patana (incision), Shodhana (cleaning), Ropana (healing) and Vakritapahama (removing the abnormalities). He even mentioned complications of inadvertent incision in Aam and Pakva vrana shotha.

## 20) Dagdh Vrana (Burns)

Acharya Sushruta has described burns caused by hot liquid or solid. These are of 4 types – Plushta (1st degree burn), Durdagdh (2nd degree burn), Samyak dagdh (3rd degree burn), Atidagdh (4th degree burn). Later he gave more varieties of burns depending on source – Dhoomophata (inhalation injury), Atapa dagdh (heatstroke), Ushna vata dagdh (sunstroke), Sheet varshanil dagdh (cold injury), Indravajra dagdh (burn due to lightening). The pathogenesis of burns is also mentioned – Agni (fire) causes vitiation of Rakta, there is aggravation of Pitta also at same speed. Both possess same Veerya, Rasa and Dravya so Pitta undergoes Vidaha and lead to severe burning sensation, formation of blebs, thirst and fever. The management of each variety is given separately and also indicated resistance of bandaging in burn injuries.

## 21) Ophthalmic Surgery

Among seventy-six ophthalmic diseases, fifty-one are surgical. The mode of operation which is to be performed in each case has been elaborately described. He has mentioned Chhedana (excision) for Vartamaarsha (form of trachoma), Shuskarsha (polyp of palpebral conjunctiva), Vartam arbud (lid tumor), Siraja pidika (episcleritis, scleritis), Arma (pterygium) and Parvanika (phlyctenule conjunctivitis); Lekhana (scrapping) for Utsangi (chalazion cyst in lower lid), Bahal vartam (multiple chalazion cyst), Kardamvartam (mucopurulent conjunctivitis), Syava vartam (inflammatory condition of eyelid) etc.

## 22) Anorectal disorders

Sushruta has described elaborately Arsha (hemorrhoids) and Bhagandara (fistula-in-ano), their definition, causes, classification, clinical features, treatment etc. In addition, he has also mentioned about Charmakeel (anogenital warts), Sannirudha guda (anal stricture), Guda bhramsa (rectal prolapsed), Parikartika (fissure-in-ano) etc.

## 23) Ashamri (Urinary calculus)

Sushruta has given special attention towards Ashmari particularly in urinary bladder and has given details of its etiology, pathogenesis, classification, signs and symptoms, complications he said that it is difficult to cure and mentioned its treatment in detail along with its surgical management.

## 24) Swellings

All kind of swellings, generalized or localized; Shotha (edema), Granthi (cyst/lipoma), Arbuda (tumour), Gulma (abdominal Swelling/tumors), Udavarta (abdominal distension due to flatulence) etc. find a place in Sushruta's work



Cover Page



DOI: <http://ijmer.in.doi./2022/11.01.120.1>

along with aetiology, symptoms, prognosis and management – medical or surgical whatever needed. Some of their surgical management is as follows.

### **i) Dakodara (Ascites)**

- Vedhan karma i.e., tapping is performed. Vedhan is done below & left lateral to umbilicus (4 Angula from line of hair) with the help of Vrihimukha shastra (trocher) to the depth of thickness of the center of thumb and a Nadi (cannula) is fixed to the trocher for removing fluid and abdomen is bandaged tight after that. All fluid should not be drained in one day itself as it will lead to complications as mentioned clearly by Sushruta.

### **ii) Baddha-gudodar (Intestinal obstruction)**

- Incision is made at four Angula (finger breadth) apart from midline on left side below the umbilicus (left paramedian), the intestine is pulled out through the wound and examined, obstruction is removed & intestine is returned back to abdomen after anointing it with Madhu (honey) and Ghrita. Then Udar sivan (abdomen closer) is done. Chhidrodar (Intestinal perforation) – Shalya is removed as above, cut ends of the intestines are brought closer and got bitten by Pipilika (big black ants) in the perforated part of intestine, the body of these ants is cut and removed leaving behind their heads only after they have stuck up well which resemble today's advanced method for intestinal suturing and the abdomen is closed.

### **iii) Arbuda (Tumor) -**

According to Sushruta, Arbuda are gradually increasing, big, globular, slightly painful, fixed, deep-seated, fleshy masses that usually do not suppurate. They can arise from any part of the body surface. They are caused by derangement of Mamsa and Rakta dhatu vitiated by Tridosha. While describing the treatment of tumors, Sushruta has explained beautiful how to use Kshara sutra in an Arbuda.

### **25) Bhagna (Fractures and Dislocations)**

The major part of surgery was indeed concerned with trauma and its management. Fall, compression, blow, sudden muscle contraction/throw, animal bite etc. led to Asthi bhagna which is of two types – Kanda bhagna (fractures, 12 subtypes) and Sandhimukta (dislocation, 6 subtypes). The twelve types of Kanda bhagna include a wide range from greenstick and hairline to compound and comminuted fractures. Signs, symptoms of each and prognosis have been mentioned. Detailed management of these has been given with 4 basic principles – Aanchan (traction), Peedan (manipulation), Sankshepa (optimum position for fixation) and Bandhan (immobilization by splints and bandaging) which is nowhere less than the contemporary orthopedic practice.

**26) Sandhana karma (Plastic surgery)** In old days one of the royal punishments was to cut away the ear lobules, nose etc. Indian surgeons have applied their techniques for correcting such deformities by shifting the skin flap to reform the nose, ear and lips, whose detailed description is given by Sushruta. He explained Rhinoplasty, classification of mutilated ear lobe defects and techniques for repair of torn ear lobes (15 different types of otoplasties), cheek flap for reconstruction of absent ear lobe, repair of accidental lip injuries and congenital cleft lip.

### **27) Koshtabheda (Abdominal injuries)**

Sushruta gave description of abdominal injuries also. He Stated its features and management.

(i) When Medovarti (omentum) comes out of abdomen, it should be smeared with astringent drugs, ash or mud, tied with thread, cut using heated sharp instrument and placed back.



Cover Page



DOI: <http://ijmer.in.doi./2022/11.01.120.1>

ii) Koshtha shalya aharana (Removal of foreign bodies from abdomen) - The foreign body logged inside should be removed by incising the abdomen.

**28) Stri and Prasuti rog (Gynaecology and Obstetrics)** Sushruta was the first to mention caesarean section done frequently these days. He also mentioned surgical management of Mudhagarbha (intrauterine deaths), Caesarean Section.

### 29) Vriddhi

**a) Antravriddhi (Inguinal hernia)** – It has been explained clearly how a hernia is formed by Acharya and in its management Agni karma and Siravedha has been mentioned. And has considered Kosh prapta antravridhi (hernia descending to scrotum) to be Asadhya (incurable).

**(b) Mutravriddhi (Hydrocele)** - Vedhan karma i.e., tapping of fluid collected in tunica vaginalis layer is advised in Mutraj-vriddhi. The site of tapping is lateral side of Sevani (raphe) of scrotum to avoid injury to testis & then remove the fluid with the help of Vrihimukh nadiyantra (trochar).

**c) Medaj vridhi (Sebaceous cyst of Scrotum)** – Swelling is wrapped with cloth bands, incised using Vriddhipatra (sharp instrument - bistoury) protecting the Phala (testis) and Sevani (raphe); fat removed by scrapping.

**30) Nirudhprakash (Phimosis)** – Nadi yantra (A tube with opening at both ends) made from either wood or iron, smeared with ghee are introduced into urethra, thicker tube is inserted after every 3 days thereby widening the urethral passage. If it fails then Shastra karma is done in which Sevani (raphe) is cut open and treated like a wound. It resembles dorsal slit in today's practice.

**31) Parivartika (Paraphimosis)** – Sushruta has given manual replacement of foreskin slowly after lubricating it with Ghrita (ghee). Prepuce is slowly pulled forward and Mani (glans penis) is pushed in, after Mani has gone into the prepuce warm poultice is tied for 3-5 days.

32) Kadar (Corn) – It should be removed out by sharp instrument (excision), then the site is burnt with hot oil.

**33) Shira shalya (Foreign body in skull)** - After removing foreign body from skull, wicks made of hair are inserted into the wound otherwise Mastulunga (brain matter) may flow out of the wound and may kill the patient.

### 34) Raktatrava nirodha karma (Methods of preventing bleeding)

Acharya Sushruta has given four methods to prevent excessive bleeding occurring after Siravedhan (puncturing of vein). They are – Sandhana (joining the edges of the wound by use of astringent drugs), Skandhan (promoting clotting by use of cold), Pachana (styptics by use of ash, alkali etc.) and Dahana (burning or cauterisation). Kashaya drugs (Astringents) joins or unites the edges of the wound, hima (cold) makes the blood to clot, bhasma (ash) cooks the wound and daah (thermal cauterization) constricts the veins.

### 35) Commentaries on Sushruta Samhita:

Sushruta samhita is studied and referred by many students, teachers, research workers and physician who are practicing Ayurveda all over the country and abroad. Considering the importance of Shalya - Chikitsa, many scholars have composed their commentaries in Sanskrit and other languages. Out of them many commentaries are lost and very few are available in incomplete condition. From various sources and citation, it came to notice that more than 19 Sanskrit commentaries were written on Sushruta samhita. The following are the commentators with their work. It is our bad luck



Cover Page



that we have lost many valuable commentaries on this most important treatise. Since the greatness of Sus hruta samhita has spread too many countries therefore it is translated in almost all regional languages of India and also of some other countries.

So far about 19 commentators are known, having been mentioned by Dalhana and so earlier 12th cent AD. Nibandha Samgraha the only ancient commentary available now in full and in print is that of Acharya Dalhana. Two other commentaries available now in incomplete form are:

1. Nyavachandrika or Brihat Phanjika of Gayadasa (10th cent AD) for Nidana Sthana only.
2. Bhanumati of Chakrapanidutta (11th cent AD) for Sutra Sthana only.

Another recent commentary in Sanskrit is that of Haranachandra Chakravarti son of Anandachandra Chakravarti and disciple of Kaviraj Gangadhara Roy. His commentary is known as "Sushrutatha Sandipana" which is very important to understand Sushruta samhita.

### 36) English Translations of Sushruta samhita

Some sections of the text have been translated to English language by U.C. Dutta in 1883, A. C. Chattopadhyaya in year 1891 and A.F.R. Hornele in year 1897. English translation of the full text has been done by Kaviraja Kunjalal Bhishagratna (1907) in 3 volumes, which is available now. Prof. P.V. Sharma along with commentary of Dalhana 1999. and K.R. Srikanthamurthy (2000) is being published.

### 37) Hindi Translations of Sushruta Samhita

Due to its importance and practical applicability, Sushruta Samhita has been translated into Hindi language by many authors. Some such important ones are –

1. Kashinatha pandey and Gorakhanath Chaturvedi (Vidhotini Tika)
2. Dr. Brahmanand Tripathi (Charak Chadrika)
3. Ravidutta Tripathi (Vaidyamanorama)

### 38) Translations Sushruta samhita in other language

Sushruta samhita has attracted the attention of scholars of other countries also from early days. Owing to its popularity, importance & practical applicability the Sushruta Samhita has been translated into many other languages such as Arabic, Latin and German. Some such important ones are - 1. Ibn\_Abila\_sibal (9h cent AD) translated Sushruta samhita into Arabic language under the name "Kitab sashool-e-Hind" or "Kitab-e-Susrud". This has been referred to by Al- Rhazi (Rhazes) the famous physician, as an authority of surgery. 2. F. Hesslar has translated Sushruta samhita into Latin language in year 1844 and into German language in year 1846 by J.A. Vullars.

## CONCLUSION

The Sushruta samhita is famous as one of the remarkable accomplishments of ancient Indian science and Acharya Sushruta is the most celebrated physician and surgeon in India. Sushruta samhita provides us simple, precise logical and



Cover Page



DOI: <http://ijmer.in.doi./2022/11.01.120.1>

practical keen knowledge on various Surgery related topic. Through his genius and intuition, Acharya Sushruta made landmark contributions to Ayurveda. Sushruta samhita covers all aspects of medical science with special importance to Shalya Chikitsa and remains par excellent on that subject. The contribution of Acharya Sushruta to surgery has laid the strong foundation for Modern Surgery. Acharya Sushruta has covered every topic related to surgery right from the dissection, anatomical consideration to the description of diseases and management which are being used with same basic principles in today's surgical era with modification and amendments. His contribution towards the Indian traditional medicine and the ancient cultural heritage of India will always be a precious. Sushruta Samhita is the key reference book for all the Ayurvedic surgeons. Due to his renowned and wonderful achievements in the field of surgery, Acharya Sushruta is rightly called as the "Father of surgery & "Father of Plastic surgery". Therefore, considering the above all facts it is concluded that Sushruta Samhita is A unique encyclopedia of Ayurvedic Surgery.

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