



**International Journal of Biology, Pharmacy
and Allied Sciences (IJBPAS)**
'A Bridge Between Laboratory and Reader'

www.ijbpas.com

SURGICAL PRINCIPLES EVOLVED IN SUSHRUTA SAMHITA- AN ANCIENT TEXT BOOK OF SURGERY

KEMBHAVI SA^{1*}, TOSHIKHANE H² AND SHARMA M³

1: Ph D Scholar, Parul Institute of Ayurveda, Parul University, Vadodara, Gujarat, India

2: Dean faculty of Ayurveda, Parul Institute of Ayurveda, Parul University Vadodara,
Gujarat, India

3: Professor Emeritus ,S D M Ayurveda College and Hospitals Udupi Karnataka

*Corresponding Author: Shivanand A Kembhavi: E Mail: drshivanandk.sk@gmail.com

Received 12th Dec. 2021; Revised 14th Jan. 2022; Accepted 7th Feb. 2022; Available online 5th March 2022

<https://doi.org/10.31032/IJBPAS/2022/11.3.1055>

ABSTRACT

Ayurveda a science of life. It is described as upaveda of *Ahtarvana veda*. This knowledge of complete health science is as per literatures it was recalled by lord *Brhama*. Later this knowledge transferred to *Dakhsh prajapaitn* then to *Ashwini kumar* and others. *Ayurveda* is divided into eight branches. Each of them describes details of different branches. Among these eight branches *Shalyatantra* is one.

Dhanvantari Sampraday is known as school of surgery. *Sushruta* main disciple of this school wrote treatise known as *Sushruta samhita* . It describes many surgical principles along with surgical ethics. Whole world agrees that *Sushruta* as father of surgery. *Charak Samhita*, *Sushruta Samhita* and *Ashtang Hridaya* are the three main treatise of *Ayurveda* and are termed as *Bruhutruyee*. *Sushrut Samhita* is one of the important texts of *Ayurveda*, which is divided into six sthana *Sutra Sthan*, *nidana Sthan*, *Shareer sthan*, *Chikitsa sthana*, *Kalpa sthana*, and *Uttar tantra*. *Sushruta smahita* describes many basic principles related to surgery in *sutra sthana*, It also through light on many surgical techniques like *Vrina ropana*, *Nasa Sandhana*, *Bhgna Chikitsa*, *sandi mukta chikitsa in chikitsa sthans* . Hence *Sushruta* is regarded as father of surgery. Everyone agrees *Sushruta* as father of plastic surgery. Unfortunately our own Indian people are unaware of many such facts. It is difficult to explain all the surgical techniques mentioned in *Sushruta samhita* for different surgical

disorders, in a single article, hence here we tried to recollect the general surgical principles and surgical techniques mentioned in *Sushruta samhita*.

INTRODUCTION

Ayurveda a science of life is described as *upaveda* of *Ahtarvana veda*. This knowledge of complete health science is as per literatures it was recalled by lord *Brhama*. Later this knowledge transferred to *Daksh prajapati*, then to *Ashwini kumar* and others [1]. *Ayurveda* is divided into eight specialities. Each of them describes details of different branches. *Dhanvantari Sampradaya* is known as school of surgery. *Sushruta* main disciple of this *sampradaya*, wrote a treatise known as *Sushruta samhita*. It describes many surgical principles along with surgical ethics. Whole world agrees that *Sushruta* as father of surgery. *Charak Samhita*, *Sushruta Samhita* and *Ashtang Hridaya* are the three main treatises of *Ayurveda* and are termed as *Bruhutruyee*. *Sushtut Samhita* is one of the important treatises of *Ayurveda*. *Sushrut samhita* is divided into six *sthana* *Sutra Sthan*, *nidana Sthan*, *Shareer sthan*, *Chikitsa sthana*, *Kalpa sthana*, and *Uttar tantra*. [2]

Sutra sthan deals with general information regarding surgical principles. *Nidan sthan* deals with diagnostic parts of the diseases in detail. *Shareer sthana* deals with detailed anatomy and embryology, for which *Sushruta samhita* is regarded as the best

treatise; *Chikitsa sthana* deals with treatment details, *Kalpa sthana* deals with toxicology; *Uttara tantra* describes *Kayachikitsa*, *Balaroga*, *Griha chikitsa*. [3]

Sushruta samhita describes many basic principles related to surgery in *Sutra sthana*, It also through light on many surgical techniques like *Vrina ropana*, *Nasa Sandhana*, *Bhigna Chikitsa*, etc in *chikitsa sthans*. Hence *Sushruta* is regarded as father of surgery. Whole world agrees that *Sushruta* as father of plastic surgery

The Shalya-Tantra Surgery

The branch of Medical Science which deals with the detailed diagnostics and management of wounds, any removal of substances such as, wooden pieces, particles of stone, dust, iron or bone; splinters, nails, hair, clotted blood, or pus, or to remove dead foetus from uterus, and to deal with the principle and mode of using and handling surgical instruments in general, and with the use of cautery and caustic substances, together with the diagnosis and treatment of ulcers, is referred as *Shalya tantra*. [4]

Historical examples of surgery in ancient India:

In *puranas* we get the explanation of about *Yajna Sira* (Head) *sandana*

(procedure of Uniting). When the head of *Yajna* (God Of Sacrifice) was severed by Lord *Rudra*, then all Gods approached *Ashvin Kumars* for the help. Later *Ashvin kumars* reunited the severed head of *Yajna* with his body. This example from *puranas* proves that *shalya tantra* (surgery) is the oldest branch of *Ayurved* and was in practice. [5]

The important surgical principles and surgical ethics:—

Ethics of teaching

Importance of learning process.

Sushruta Samhita contains detailed descriptions of teachings and practice of the great ancient surgeon *Sushruta* and has considerable surgical knowledge of relevance even today.

Understanding this now is essential to know that surgery was in practice in ancient India.

The descriptions of *Sushrut samhita* are not merely theoretical description. *Sushrut* starts his explanations from the basic point, explaining details of how to study this science. Few of the examples which tells us that he was concerned about the simplest things like, He highlight about the selection of the student, induction of them to the school (*Shishyopananyana*) he mentions about the dress code and its importance, importance of teacher etc. *Sushruta* in the beginning only mentions the importance of

studying theory and practical aspects in the medical sciences, specially surgery. [6]

A pupil who is pure, obedient to his preceptor, applies himself steadily to his work, and abandons laziness and excessive sleep, will get complete knowledge of the science. There is explanation about importance of soft speech and being obedient A student or a pupil, after learning the science will be engaged in cultivation of fine speech and constant practice in the art he has learnt, and make efforts towards the attainment of perfection (in the art). This highlights the importance of continues learning and constant practice. [7]

If we study only theory and become, well versed in the principles of the science of medicine (*Ayurveda*), but unskilful in his art through practical knowledge, such person loses his confidence at the bedside of his patient, just as, a coward fails to determine what to do when for the first time he finds himself in the ranks of a contending army. On the other hand a physician, experienced in his art but deficient in the knowledge of the *Ayurveda* (medical science, is condemned by all good men as a quack, and deserves capital punishment at the hands of the king. Both these classes of physicians are not to be trusted, because they are inexpert and half educated. Such men are incapable of

discharging the duties of their vocation, just as a one-winged bird is incapable flying in the air. [8]

Another slimily given in *Sushruta samhita* to highlight the importance of practical and theoretical knowledge,

A foolish person who has gone through a large number of books without gaining any real insight into the practical knowledge, is like an ass laden with logs of sandal-wood, that labours under the weight which it carries without being able to appreciate its virtue. [9]

Quality and safety should be aimed for in all areas of surgical and medical care. Quality and safety include supervision of less experienced professional trainees and non-surgeons who perform surgical procedures. [10]

One study highlights the need for increased supervision of new graduates after formal surgical training as well as for more training and supervision of associate clinicians and general practice physicians who perform operations, anaesthesia, or obstetrics [11].

Importance of studying the different sciences

He also mentions the importance of studying all allied sciences to become perfect.

By the study of a single *Shastra* (science) a man can never catch the true import of this

(Science of Medicine). Therefore a physician should study as many allied branches of (science or philosophy) as possible. Present day's medical science or specially the surgery branch has grown to this extent just because of utilizing the allied sciences.

Tremendous development like different types of scopes, used in the investigation and surgical practice are the contributions of others sciences. [12]

Ethics related quackery.

In *Sushruta's* time also there were people who were unqualified and practicing medical science. He condemned quackery and mention in verse stating, The physician who studies the Science of Medicine from the helps of his preceptor, and practises medicine after having acquired experience in his art by constant practice, is the true physician, while any other person expert in practical art but not studied the science under a teacher, should be looked upon as quack..

By this we can understand how much they were serious about the ethics in the medical practice [13]

Classification of the surgical procedures into 3 main sub heads

The entire course of medical treatment in connection with a disease may be grouped under three subheads. In the present days of surgical practice also we

divide whole surgical protocol into 3 steps of measures.

1. Preliminary measures (*Purva-karma*); - Pre Operative
2. Principal therapeutic or surgical appliances (*Pradhana-karma*) - Operative
3. After-measures (*Paschatkarma*); - Post Operative [14]

In *Poorva karma Sushruta* directs surgeon to keep things ready, which are essential to perform any sort of surgical or Para surgical procedures. He quotes

“A surgeon (*Vaidya*) before starting the operations, must first equip himself with such accessories as surgical appliances and instruments, alkali, fire, probe or director (*Shalaka*), horns, leeches, gourd (*Alavu*), *Jamvavoushtha* (a kind of pencil shaped rod made of slate with its top-end cut into the shape of a Jamboline fruit), cotton, lint, thread, leaves, honey, clarified butter, lard, milk, oil, decoctions (*Kashaya*), medicated plasters, paste (*Kalka*), fan, cold water, hot water, and cauldrons, etc. He shall secure the services of devoted and strong attendants.” These were the materials which were used in the surgical practice in those days. [15].

This simple thing also tells us that *Sushruta* was aware of simple things essential for surgery and he performed many surgeries and found importance of materials keeping

ready before hand. Its not mere theoretical description.

Qualities of a good surgeon.

Surgeon should possess few important qualities. Courage, light handedness, non-shaking, non-sweating, sharp instruments, self confidence and self command are what should be possessed by a surgeon engaged in opening a boil or an abscess. [16]

Principles of aseptic operation theatre and post operative wards.

Fumigation:

Fumigation referred as *Dhoopana* in the two fundamental texts of Ayurveda, *Charaka Samhitha* and *Sushruta Samhitha*, is prescribed for treatment of various ailments and disinfection of environment and inanimate objects. Importance of Fumigating the operation theatre, labor ward and post operative ward is mentioned in the *Susrhut samhita*. He recommends the use few herbs which have *kirmigna*(anti viral or anti bacterial) properties. [17]

In the wards when a patient with a infective wound is under treatment, Its said the limb of the wound ,and the whole post op ward should be fumigated with the drugs, like *Guggulu*, *Vacha*, white mustard, *Saindhava* and the leaves of the *nimba* tree. This clearly indicates that they were aware

about the harmful effects of germs, and they took care of handling it. [18]

A study strongly suggested that the traditional Ayurvedic fumigation with natural plant products is effective in reducing air-borne bacteria and in disinfecting inanimate surfaces. The traditional fumigation with herbal products has huge potential to address the problem of nosocomial infections. [19]

Keeping patients nil oral before surgical procedure.

In a case of artificial or instrumental parturition, in ascites, in piles, in stone in the bladder, in fistula in ano, and in diseases affecting the cavity of the mouth, the patient operated On should be kept on an empty stomach.

This also clearly tells us that he practised many surgical procedures and he might have faced the problem when patient was given food prior to the procedure that's why he directs to keep patient to keep nil orally before the procedure [20].

Surgical acts are divided into eight. (Ashtvidha shastra karma)

Coming to the main surgical knowledge, *Sushruta* describes eight types of different surgical acts. If we go through the description of all these eight kinds of surgical procedures, we understand that we can include all the present days diagnostics and therapeutic procedures in any of these

eight acts. This indicates that *Sushruta* was well versed with all the surgical procedures and he performed them, then only he could include all these details. [21]

- 1) *Chedana*, - (Incising)
- 2) *Bhedya* - (Excising)
- 3) *Lekhya*- (Scraping)
- 4) *Vyadana* (Puncturing)
- 5) *Eshana* , (Probing)
- 6) *Ahasrana*- (Extracting),
- 7) *Visravaya* - (draining Secreting fluids)
- 8) *Seevya*.- (Sututring)

Incision

Qualities of good incision

Sushruta while describing the qualities of incision he mentions few things which clearly explains us that he was very efficient surgeon and conducted many surgical procedures hence he could document very minute and practically relevant things. He explains as follows.

-an incision which is wide, extended, well divided, does not involve any vital part, etc. of the patient, is the best of its kind. Here wide incision helps a surgeon to perform surgical procedure very easily and fast. The days of *Sushruta* when there was non availability of more effective anaesthetic measures, to complete procedure easily and swiftly it was necessary to take wide incisions. Today's surgical text book to mention that a surgeon should never

hesitate to take wider incisions. Well divided incision always helps in good and faster healing with minimum scar formation.

Two or three incisions should be made if a single opening does not seem large enough for the purpose. The knife should be freely used wherever a fissure, sinus, or a cavity would appear in a boil, so as to ensure a complete flowing out of the pus accumulated in it [22].

Different types of incisions based on the site of the pathology.

Lateral (tiriyaka) incisions should be made in regions of the eye-brows, temple, forehead, cheeks, eyelids, lower lip, gums, armpits, loins, belly and the groins.

An incision made in the region of the hand or root should be made to resemble the disc of the moon, while those about the anus and the penis should be made

semi-circular, half-moon in shape. An incision in any of the above said regions not made as directed, may give rise to extreme pain, prolonged granulation (healing) and condylomatous growths in and about the ulcer, owing to an inadvertent cutting of the local veins, or nerves [23].

Principles of treatment in few surgical diseases

Illustrative list of few surgical conditions where different surgical interventions have been recommended in Sushruta Samhita

Disease names	Surgical principle of management	Modern terms
Bhagna (Sushruta, chikitsa stana Chapter 03)	Traction , reduction and immobilization , followed by physiotherapy	Different types of fractures and dislocations
Arhses (Sushruta, chikitsa stana Chapter 06)	Para surgical procedure like cautery, kshara(application of alkaline medicine), and excision	Different types of haemorrhoidal pathologies
Bhagandhar (Sushruta, chikitsa stana Chapter 08)	Excision with different types of incision, and in stages	Different types of Fistula in ano.
Baddo gudodar. (Sushruta, chikitsa stana Chapter 14)	Laparotomy	Intestinal obstruction (due to fecoliths of trychobezore or any growths.
Chidrodera (Sushruta, chikitsa stana Chapter 14)	Laparotomy and peritoneal lavage, Closure of the perforated site with organic suture materials(using ants)	Intestinal perforation.
Udakodar (Sushruta, chikitsa stana Chapter 14)	Tapping (care should to be taken not to tap whole fluid in a single sitting)	Ascitis

The above mentioned few surgical diseases and their principles of management clearly describes that surgery was widely practised in *Sushrutas* period. The present day's surgical protocol of dealing with above mentioned diseases is quite similar to what *Sushruta* has mentioned. The way of dealing with them differs but the principal of remains same. To give few examples

Principles of management of fracture;

In the management of *Bhagna* (Fracture) *sushruta* principal of management is *Aanchan* (Traction), *peedan*, *samkshepana* (reduction) and *bandhana* (immobilization). In the present day orthopaedics also advocates the similar principals but change in the way we deal with it. In *Sushruta samhita* he advises to make use bamboo or different types of barks of the plant to immobilize the fractured site, but today it's replaced by the plaster of paris. [24]

Principles of management of Ano rectal diseases;

Similarly in the treatment of *Arsho roga* (Hemorrhoids and other Ano rectal diseases), *Sushruta* mentions four types of treatment. Surgical treatment is indicated as the last option of the treatment. He clearly states that when all the measures of treatment fails and in the situation where

the haemorrhoidal mass is having narrow base, prominently protruding out, and associated excessive bleeding surgery should be considered. [25]

Principles of management of Abdominal disorders

In acute abdominal conditions explained in the chapter by name *Udara roga chikitsa* *Sushruta* recommends the principles as follows.

Laparotomy preferably left para median incision

Peritoneal lavage

Approximation of the cut edges of intestinal (in perforation condition)

Suturing.

Replacing coils of intestine in the abdomen

Then closer of wound.

In the case of *Chidro dara* (Intestinal perforation) parts should he held together(proper approximation of the wound edges) by applying living black ants to their ends, then their bodies should be cut off, leaving only the heads to serve like suturing material. The same is followed now modern improved surgery where an animal tissue like catgut is expected to fulfill. After this the intestine should be fairly replaced in the abdominal cavity and the external opening stitched and properly dressed. [26]

Surgical instruments.

In *Sushruta samhita*, *Sushruta* mentioned one hundred and one surgical instruments. *Sushruta* says that, of all the instruments, hand is the most important one, as the instruments are of no use without the use of hand. To be successful in surgery, the surgeon should be well versed with the instruments. He should practice the handling of the instruments before using them on patients. [27]

Types .

Broadly the all instruments are classified into two,

1. Yantra (Blunt instruments) - 100
2. Shastra. (Sharp instruments) - 20

Yantras are again classified into 6 types based on shape and their utility.

Table 2: Instruments

Type of instrument (Sushruta)	Meaning	Numbers
<i>Svastika,</i>	Cruciform instrument	24
<i>Sandansha,</i>	Dissecting forceps or tongs	2
<i>Tala,</i>	Spoon shaped instruments	2
<i>Nadi Yantras</i>	Tubular instruments	20
<i>Shalakas</i>	Rod like instruments	28
<i>Upayantras</i>	Accessory instruments	25

1. Cruciform instruments (Svastika yantras) -The Svastika yantras (forceps) are divided into twenty four sub classes. They resemble the mouths of beasts or birds. They are mainly used for extracting thorn or foreign bodies embedded in bones. [28]
2. Dissecting forceps or tongs (Sandansha yantras) -The Sandansha yantras are divided into two classes and are with or without locks. They are used for extracting foreign bodies from skin, muscles, blood vessels and ligaments. [29]
3. Spoon shaped instruments (Tala yantras)- Tala yantras have one

or two surfaces resembling the scale of a fish. They are used for extracting foreign bodies from the ear, nose or a sinus. [30]

4. Tubular instruments (Nadi yantras)- Nadi yantras, which are of various types, are used for removing foreign bodies and inspection and treatment of disease spots of external orifices. They are of different diameters and lengths depending on the dimensions of the passage. Endoscopes come under the category of tubular instruments. They are used in piles, fistula in ano, anal stenosis etc. The arsho yantra

(rectal speculum for piles), bhagandara yantra (rectal speculum for fistula in ano) and yoni vranekshanam (vaginal speculum) are some of the examples of endoscopes for examination of external body orifices. They are described in detail separately. [31]

5. Rod like instruments (Shalaka yantras) Shalaka yantras are of several types and are used for different purposes having lengths and circumferences depending on the site of application. [32]
6. Accessory instruments (Upa yantras) These are rope, intertwined thread, bandages, leather straps, bark, creeper, linen cloth, round pebble, stone, hammer, palm and sole, finger, tongue, teeth, nail, mouth, hair, ring of a horse's bridle, twig of a tree, spittoon, evacuating, exhilaration, magnetic stone, caustic, fire cautery and drugs. [33]

Materials used to prepare instruments

These instruments are all made of iron which may be substituted for any other similar or suitable substance where iron would be unavailable. [34]

Good qualities of instruments

Neither too large nor too small, and their mouths or edges should be made sharp and keen. They should be made with a special eye as to strength and steadiness, and they should be provided with convenient handles. [35]

Surgical instruments tempering.

The instruments should be tempered with one of the three substances such as, alkali, water, and oil. This particular procedure will help to keep instruments in good condition [36].

Importance of Blood in surgical practice.

Blood is the origin of the body. It is blood that maintains vitality. Blood is life. Hence it should be preserved with the greatest care.

Excessive bleeding will result in death. Sushrut mention the features of bleeding [37].

Principles of haemostasis.

The four measures indicated for the stoppage of bleeding are known; as the Sandhanam (process by contracting the affected part), the Skandanam (thickening or congealing the local blood), the Pachanam (process of setting up suppuration in the wound) and the Dahanam (process of cauterisation). [38]

Bandaging;

Sushruta mention different types of bandaging techniques. There fourteen types of bandaging explained. [39] The old bandage should be loosened on the third day of the operation, when the wound or the ulcer should be washed, and a fresh bandage should be wound round as before. The bandage should not be loosened on the day following the lancing of a boil, as such a measure might give rise to a sort of excruciating pain and formation of knots in the wound and retard the process of granulation (healing). On the third day, the surgeon (*Vaidya*) should prescribe the proper medicated plaster, diet, etc. After fully considering the strength of the patient, the nature of the disease, and the then prevailing season of the year. [40]

A wound should not be tried to be healed up, as long as the least morbid matter, or pus remains in its inside, as it would lead to the formation of fresh cavities in the surrounding health tissues, and ultimately to a recrudescence of the disease.

Sushruta was specific about the changing the dressing and advised to change based on the seasons. The dressings and bandages should be untied and changed ever third day in winter, in spring and in the season of Hemanta, and on each alternate day in summer and in the rains. [41]

Important surgical ethics

Explaining prognosis before doing surgery.

Sushruta while explaining the treatment of different diseases clearly mentions the importance of explaining prognosis to the patient and patients relatives. In certain cases he clearly states not to do treatment. In the treatment of *Udara roga* (abdominal diseases) he clearly says *baddagudodar* and *chidrodar* are difficult to treat, if we treat chances of recovery are less. So he instructs to explain the prognosis before beginning the treatment. Next he quotes that, all the eight types of *udar roga* if neglected and when they become chronic all will end up with very poor prognosis. [42]

Ethics pertaining to Consent

The principle of consent is a relatively new condition. In fact, already in the times of not only the Egyptian civilisation, but also the Greek and Roman, documents have been found which show how the doctor's intervention had, in some way, first to be approved by the patient. Plato (law IV) had already foreseen the problems, the procedures and the modes of information which are, in synthesis, at the root of the principles of the present formula of informed consent and correlated the practice of the information and consensus with the quality and social position of the

patient. The only guarantee that the patient might have, derived from a fundamental principle of medicine of all times: "in disease, focus on two aims, to improve and not to cause damage". [43]

Sushruta explained the importance of consent while explaining the treatment of Ashmari(bladder calculi) He highlights the importance of explaining the difficulties involved and the possible complications like death during the surgical treatment.[44]

CONCLUSION

The surgical ethics and techniques mentioned in sushrut samhita and relevant in the present era too. The detailed description of different types of instruments, and their making, pre operative preparations and sterilisation of operation theatre and post operative ward etc are clear indicative of wide ethical surgical practice in Sushrutas time. The description of specific indication and contra indication and principles of surgical management of different surgical diseases is evident that Sushruta performed many surgeries and was the first perform to perform plastic surgery. Modifications of the treatment principles is always welcomed by all sages in the ancient India. Sushruta was a sage, a teacher, philosopher, and a great surgeon.

REFERENCES

- [1] Bhishagratna KL, editor. An English translation of The Sushruta Samhita: based on original Sanskrit text. author; vol.1,Sutra Sthana chapter 1. ch1907.
- [2] Bhishagratna KL, editor. An English translation of The Sushruta Samhita: based on original Sanskrit text. author; vol.1,Sutra Sthana chapter 1. ch1907.
- [3] Bhishagratna KL, editor. An English translation of The Sushruta Samhita: based on original Sanskrit text. author; vol.1,Sutra Sthana chapter 1. ch1907.
- [4] Bhishagratna KL, editor. An English translation of The Sushruta Samhita: based on original Sanskrit text. author; vol.1,Sutra Sthana chapter 1. ch1907.
- [5] Bhishagratna KL, editor. An English translation of The Sushruta Samhita: based on original Sanskrit text. author; vol.1,Sutra Sthana chapter 1. ch1907.
- [6] Bhishagratna KL, editor. An English translation of The Sushruta Samhita: based on original Sanskrit text. author; vol.1,Sutra Sthana chapter 2. ch1907.
- [7] Bhishagratna KL, editor. An English translation of The Sushruta Samhita: based on original Sanskrit

- text. author; vol.1,Sutra Sthana chapter 3. ch1907.
- [8] Bhishagratna KL, editor. An English translation of The Sushruta Samhita: based on original Sanskrit text. author; vol.1,Sutra Sthana chapter 3. ch1907.
- [9] Bhishagratna KL, editor. An English translation of The Sushruta Samhita: based on original Sanskrit text. author; vol.1,Sutra Sthana chapter 4. ch1907.
- [10] Yohannes Y, Mengesha Y, Tewelde Y (2009) Timing, choice and duration of perioperative prophylactic antibiotic use in surgery: a teaching hospital based experience from Eritrea, in 2009. J Eritrean Med Assoc 4:65–67)
- [11]) Meara JG, Leather AJ, Hagander L et al (2015) Global surgery 2030: evidence and solutions for achieving health, welfare, and economic development. Lancet 386(9993):569–624. [https://doi.org/10.1016/S0140-6736\(15\)60160-X](https://doi.org/10.1016/S0140-6736(15)60160-X)
- [12] Bhishagratna KL, editor. An English translation of The Sushruta Samhita: based on original Sanskrit text. author; vol.1,Sutra Sthana chapter 4 verse 35. ch1907
- [13] Bhishagratna KL, editor. An English translation of The Sushruta Samhita: based on original Sanskrit text. author; vol.1,Sutra Sthana chapter 4 . ch1907
- [14] Bhishagratna KL, editor. An English translation of The Sushruta Samhita: based on original Sanskrit text. author; vol.1,Sutra Sthana chapter 4 verse 35. ch1907
- [15] Bhishagratna KL, editor. An English translation of The Sushruta Samhita: based on original Sanskrit text. author; vol.1,Sutra Sthana chapter 4. ch1907
- [16] Bhishagratna KL, editor. An English translation of The Sushruta Samhita: based on original Sanskrit text. author; vol.1,Sutra Sthana chapter 5. ch1907
- [17] Bhishagratna KL, editor. An English translation of The Sushruta Samhita: based on original Sanskrit text. author; vol.1,Sutra Sthana chapter 5. ch1907
- [18] Bhishagratna KL, editor. An English translation of The Sushruta Samhita: based on

- original Sanskrit text. author;
vol.1,Sutra Sthana chapter 5.
ch1907
- [19] .
<https://doi.org/10.1016/j.jaim.2019.05.002>.
- [20] Bhishagratna KL, editor. An English translation of The Sushruta Samhita: based on original Sanskrit text. author; vol.1,Sutra Sthana chapter 5. ch1907
- [21] Bhishagratna KL, editor. An English translation of The Sushruta Samhita: based on original Sanskrit text. author; vol.1,Sutra Sthana chapter 5. ch1907
- [22] Bhishagratna KL, editor. An English translation of The Sushruta Samhita: based on original Sanskrit text. author; vol.1,Sutra Sthana chapter 5 ch1907
- [23] Bhishagratna KL, editor. An English translation of The Sushruta Samhita: based on original Sanskrit text. author; vol.1,Sutra Sthana chapter 5 ch1907
- [24] Bhishagratna KL, editor. An English translation of The Sushruta Samhita: based on original Sanskrit text. author; vol.1,Chikitsa Sthana chapter 3 ch1907
- [25] Bhishagratna KL, editor. An English translation of The Sushruta Samhita: based on original Sanskrit text. author; vol.1,Chikitsa Sthana chapter 6 ch1907
- [26] Bhishagratna KL, editor. An English translation of The Sushruta Samhita: based on original Sanskrit text. author; vol.1,Chikitsa Sthana chapter 14 ch1907
- [27] Bhishagratna KL, editor. An English translation of The Sushruta Samhita: based on original Sanskrit text. author; vol.1,Sutra Sthana chapter 7 verse 2 ch1907
- [28] Bhishagratna KL, editor. An English translation of The Sushruta Samhita: based on original Sanskrit text. author; vol.1,Sutra Sthana chapter 7 verse 8 ch1907
- [29] Bhishagratna KL, editor. An English translation of The Sushruta Samhita: based on original Sanskrit text. author; vol.1,Sutra Sthana chapter 7 verse11 ch1907

- [30] Bhishagratna KL, editor. An English translation of The Sushruta Samhita: based on original Sanskrit text. author; vol.1,Sutra Sthana chapter 7 verse 12 ch1907
- [31] Bhishagratna KL, editor. An English translation of The Sushruta Samhita: based on original Sanskrit text. author; vol.1,Sutra Sthana chapter 7 verse 13 ch1907
- [32] Bhishagratna KL, editor. An English translation of The Sushruta Samhita: based on original Sanskrit text. author; vol.1,Sutra Sthana chapter 7 verse 14 ch1907
- [33] Bhishagratna KL, editor. An English translation of The Sushruta Samhita: based on original Sanskrit text. author; vol.1,Sutra Sthana chapter 7 verse 15 ch1907
- [34] Bhishagratna KL, editor. An English translation of The Sushruta Samhita: based on original Sanskrit text. author; vol.1,Sutra Sthana chapter 7 verse 7 ch1907
- [35] Bhishagratna KL, editor. An English translation of The Sushruta Samhita: based on original Sanskrit text. author; vol.1,Sutra Sthana chapter 7 verse 9 ch1907
- [36] Bhishagratna KL, editor. An English translation of The Sushruta Samhita: based on original Sanskrit text. author; vol.1,Sutra Sthana chapter 8 verse ch1907
- [37] Bhishagratna KL, editor. An English translation of The Sushruta Samhita: based on original Sanskrit text. author; vol.1,Sutra Sthana chapter 4 verse12 ch1907
- [38] Bhishagratna KL, editor. An English translation of The Sushruta Samhita: based on original Sanskrit text. author; vol.1,Sutra Sthana chapter 14 ch1907
- [39] Bhishagratna KL, editor. An English translation of The Sushruta Samhita: based on original Sanskrit text. author; vol.1,Sutra Sthana chapter 18 verse 17 ch1907
- [40] Bhishagratna KL, editor. An English translation of The Sushruta Samhita: based on original Sanskrit text. author; vol.1,Sutra Sthana chapter 5 ch1907

- [41] Bhishagratna KL, editor. An English translation of The Sushruta Samhita: based on original Sanskrit text. author; vol.1,Sutra Sthana chapter 18 verse 26 ch1907
- [42] Bhishagratna KL, editor. An English translation of The Sushruta Samhita: based on original Sanskrit text. author; vol.1,Sutra Sthana chapter 14 verse 03 ch1907
- [43] Med Leg J 2017 Sep;85(3):145-147. doi: 10.1177/0025817217701570. Epub 2017 Mar 24
- [44] Bhishagratna KL, editor. An English translation of The Sushruta Samhita: based on original Sanskrit text. author; vol.1,Chikitsa Sthana chapter 07 verse 29 ch1907