



## Critical Review on Sushruta's Management of Bhagna

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**Abstract:** Right from ancient years to contemporary times, trauma care has been an important goal of emergency management. Orthopedic injuries have a high incidence and remain a significant challenge for trauma care. *Sushruta Samhita* has an extensive description of the management of orthopedic injuries like fractures and dislocations. According to Ayurvedic scriptures, a fracture is the loss of the bone's continuity due to pressure. The fundamental principles of fracture therapy, such as Reduction, Immobilization, and Rehabilitation, are used to treat long bone fractures. Many indigenous substances that can aid in fracture healing are documented in ancient treatises. This study aimed to explore the types and management protocol of fracture *Acharya Sushruta*. The method was followed to analyze *Sushruta Samhita*, its commentaries, and Internet surfing from various research articles. In *Sushruta Samhita*, the maximum information about the disease fracture, its classification, and symptoms are elaborated in the fifteenth chapter of *nidan sthan* and its management was described in the third chapter of *chikitsa sthan* along with extensive details of surgical and non-surgical management, dietetic indications and local applications. Ancient surgeons prioritized fractures of the pelvic area, spines, long bone shafts, and thighs, among various fractures. The rules established by *Acharya Sushruta* are so authentic that even today's orthopedic surgeons follow them. Traction and retention were used after *Unnamana* (elevation of the depressed fragment) and *Vinamana* (depression of elevated fragment) while managing shattered bones. Sudha varga dravyas were used in compound fractures, multiple fractures, and irregular fractures when the broken section is completely separated or missed in certain circumstances. As a graft material, a paste made from the decoction of *Rubia cordifolia*, Sudhavarga dravya, and latex of *Ficus Benghalensis* was applied. The research provided a thorough literature review on fracture and fundamental principles, which are valid even in today's orthopedics.

**Keywords:** Bhagna, fracture, Sushruta. Kandbhagna, anchana, peedana and sandhimukta

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## I. INTRODUCTION

Insalubrious have piqued his interest since his first steps on this planet. Trauma, being man's birth companion, has always bothered him. However, in this evolved era, with the dynamic sophistication of modern life gaining impetus, Skeletal injuries are on the rise across the board, impacting people of all ages. <sup>1</sup> *Asthi*, the fifth constituent of the body, is a complex and non-malleable connective tissue that supports the body as a framework. The importance of *Asthi* *dhatu* in the human body is rather neatly expressed by *Sushruta Acharya* in *Sharira Sthana*, fifth *Adhyaya*. The verses mean as trees stand by dint of internal heart-wood, the bodies of living beings are supported firmly by bones which are essence like heart-wood. According to *Acharya Sushruta*, *Asthi* starts developing during the third month of intrauterine life and organizes with complete manifestation in the seventh month of gestation. *Acharya* has also emphasized the importance of *shareera dharana* being the prime function of *asthi* and *sandhi*. <sup>2</sup> *Asthi* is a hard material that endures long after the majority of the body has decomposed. *Susrutha* claims that even after burying the body after death and after every other part, such as flesh and muscles, has been destroyed, and there is still substance left. Even after death, it continues to be the person's last identity<sup>3</sup>. *Shabdastomkara* claims a portion of the body that endures for a very long time, even after the body has died. <sup>4</sup> *Asthi* is synonymous with "Hada." Although every substance is composed of all five *Mahabhutas* (*Akasha*, *Vayu*, *Agni*, *Jala*, and *Prithivi*), *Prithivi* and *Vayu* *Mahabhuta* predominate in *Asthi*. *Deha Dharaṇa*, *Majja Pushti*, and supporting the *Mamsa*, *Sira*, and *Snayu* are the *Asthi Karmas* in order. <sup>5</sup> *Bhagna* words can be correlated with the fracture word of modern medicine. It signifies the break or discontinuation in the movement of bones. The word *Bhagna* has been derived from the root word "Bhanja" after adding the suffix "kta" which means to break, grind down, or separate. <sup>6,7</sup> *Sushruta* describes the numerous bones, fractures, classification, and treatment options. He has provided all of this information without any diagnostic technology, and he has proposed several reliable and effective methods for detecting the sorts of fractures and how they should be treated. Even now, such treatments are extremely beneficial in the conventional medical system. The break in continuity through the bones is known as *Kanda-bhagna*, while the break in continuity through the joints is known as *Sandhi-mukta*. Fractures and dislocations are defined in the same way in the modern medical literature. *Sushruta* elaborated the basic principles of *Bhagna Sthapna*, *Sthirikarna*, *Sukh Cheshta prasartwam*, *Bandanas* etc., for managing such injuries<sup>8</sup>. These principles are also mentioned as *Reduction*, *Immobilization*, and *Rehabilitation* in the modern medicinal system. Numerous *Lakshanas*, such as *Sparsha-asahatvam* (intolerance to touching), *Spandan* (constant throbbing pain), *Avapeedmaneshabdham* (sound during movement), *Shwathubahulya* (excessive swelling), and twisting pain are mentioned in the Ayurvedic classics for the *Kandabhagna*. The patient experiences no relief in any of the positions. The signs and symptoms of *Ashakti* of *Akinchan* (inability of flexion), *Vivertan* (movement), *Ugrarujatvam* (extreme pain), *Sparsha-asahatvam* (intolerance to touching), etc. are present if the person is experiencing dislocation<sup>9</sup>. The aim of the study is to review of fracture management in *Sushrut Samhita* to explore the types and management protocol of fracture by *Acharya Sushruta*.

## 2. MATERIALS AND METHODS

The method followed for this was a thorough analysis of *Sushruta Samhita* and commentaries of *Sushruta Samhita*.

### 2.1 Observations

Breaches in the movement of bones are of several types according to the nature of injury, such as slip, pressure, striking, excessive movement, and bites from other ferocious animals. Considering several types of breech broadly, they are grouped into two dislocations and fracture, *sandhimukta* and *kanda bhagna* respectively<sup>10</sup>. The signs and symptoms of *sandhimukta* include inability in extension, flexion, retraction, and random movements, severe pain and tenderness. Differentiating this, excessive swelling, inability to bear shaking, movement and touch of fractured arm, crepitus on pressure, looseness of the part, no relief of pain in any position, and various types of pain are the generalized signs and symptoms of *kanda bhagna*<sup>11</sup>

#### 2.1.1. The types of dislocations are

1. *Utpista* - Fracture dislocation – swelling on both the sides of the joint with varied pain at night.
2. *Vislista* - Dislocations of joints due to ligament tears – which has mild swelling, continuous pain, and deformity in the joint
3. *Vivartita* - Anterior-posterior dislocation of the head of the humerus; characterized by unevenness in part with pain.
4. *Avakshipta* - Downward displacement of the bone with separation of joint with severe pain
5. *Atikshipta* - Marked displacement of any articulation surface; with the movement of bone away from the joint with severe pain.
6. *Tiryakshipta* - Oblique dislocation in one of the articulating bones associated with severe pain.

#### 2.1.2. The types of Fractures are

1. *Karkataka* - Depressed fracture. With hyperesthesia at both the ends of the bone and the middle, the fractured part is raised like a cyst.
2. *Ashwakarana* - Complete oblique fracture- the fractured part is projected as a horse's ear.
3. *Churnitam* - Comminuted fracture has severe crepitus on palpation
4. *Pichhitam* - Fracture by compression with severe and extensive swelling
5. *Asthichallita* - Sub periosteal avulsion, when the bone is lowered and projected insides
6. *Kandabhagna* - Complete spiral fracture and bone moves on shaking off the fractured part
7. *Majjanugatam* - Impacted fracture, when the portion of the bone pierces the pith of the other end and digs out the marrow
8. *Atipatitam* - Complete compound fracture and the bone is completely divided into two
9. *Vakra* - Greenstick fracture, when the bone is bent but not separated
10. *Chinnam* - Incomplete fracture, when one side of the fractured bone remains intact
11. *Patitam* - Comminuted fracture flat bones, bones have many small cracks and is associated with pain

12. *Sputita* - Fissured fracture, if the site is as full of awns, inflated, prominent, and has many cracks.<sup>12</sup>

## 2.2 General Management of Fracture

Earlier literature reveals a treatment plan a. *Bhagna Sthapana* (Reduction) b. *Bandhana* (Immobilization or Retention) c. *Sukhchestaprasara* (Physiotherapy).

Acharya Sushruta has advocated procedures for the reduction of fractured bones as:

1. The depressed fragments should be lifted up,
2. The protruded fragments above the level of another bone or fragment should be pressed downwards. Finally, the distally displaced or deviated fragments should be brought to normal.
3. Fragments that have gone down the level of another bone should be raised up.

- This is to be done by:
  - a. *Anchana* – Traction
  - b. *Peedana* – manipulation with local pressure
  - c. *Sankshepa* – Opposition and Stabilization,
  - d. *Bandhana* – Immobilization.

Acharya Sushruta's principles for decreasing a fracture are still used today. According to him, a surgeon should first apply traction from both sides of the fragment (*Anchana*), then elevate or depress the depressed pieces (*Peedana*), and last, bring the far dislocated or overlapping fragments into close contact by manipulating them independently (*Samshepana*). Before standard immobilization, the preceding principles focus on achieving appropriate alignment of shattered fragments (*Bandhana*)<sup>13</sup>. One of the most critical aspects of treatment is proper immobilization of the fractured limb. With properly designed splints, Acharya Sushruta has adequately detailed the phase. He chose the barks of Ashwatha (*Ficus Religiosa*), Vamsha (*Bambusa*), Kakubha (*Terminalia Arjuna*), Madhuka (*Madhuka Indica*), Palasha (*Butea Monosperma*), Sala (*Shovera Robusta*), Udumbara (*Ficus Racemosa*), and Vata (*Ficus Racemosa*) (*Ficus Bengalensis*). Because these splints were readily available, they were quickly applied. Other reasons for choosing specific barks include:<sup>14</sup>

1. Barks would fit into the limb due to their concave inner surface
2. The rigid and firm outer surface,
3. Soft inside surface, acting as a cushion to the limb, preventing pressure sores.
4. Drugs with similar qualities, such as Ruksha, Kashaya, Sheet, and Mrudu, may have something to do with fracture healing.<sup>15</sup>

Acharya Sushruta recognized the necessity of rehabilitation in the form of physiotherapy for limb injuries. He prescribed some exercises that were to be started in a lower degree and gradually increased at any rate, and the exercises were not to be prescribed all at once at the start; for example, for upper limb rehabilitation, effort to lift a mud ball was to be done first, then a heavier substance such as a big rock salt, and finally a harder object such as a stone.<sup>16</sup>

## 2.3 Specific Management of Fracture

- If a Tibia or Femur Fracture occurs, the injured area should be massaged with Ghee, traction given gently

along the bone's direction, splinted with bark, and bandaged with linen. In the same way, a fractured arm is treated.

- In case of Hip joint dislocation, the reduction is to be done by traction and circumduction, and then a splint should be applied and bandaged. In case of Cracked or bruised femur fracture, the part is to be bandaged in manner mentioned above
- In case of fracture of Iliac bone, it is to be reduced by manipulative procedures, including elevation of the depressed fracture, followed by bandaging the patient; further, it is to be treated with *sneha basti*. Acharya Gayi comments that fracture of pelvic bone is incurable while dislocation of the joint is palatable.
- For dislocation of *Amsasandhi* (Shoulder joint), the *kaksha* part (axillary region) is to be raised with an iron / wooden club (*Musala*); then, the surgeon has to bandage the part by a *Swastika bandha* ('Figure of 8' bandage)
- In the case of a dislocated Elbow joint, it is first to be massaged with the thumb, and then it is to be pressed with the view to set it in its usual position, altering with flexion or extension of the same. Then any oleaginous substance should be sprinkled on top. The same precautions should be taken in the event of a dislocated knee, wrist, or ankle joint.
- In case of fracture of Metacarpal bones of palm, two palms are made even, opposed, and bandaged together for support. In case the metacarpal bones of both hands are fractured, splint is applied to each palm for support & the part is sprinkled with *Taila*.
- In cervical spine fracture in lateral flexion or shortening of the neck, traction is applied upward, an appropriate splint is provided, and the patient is instructed to remain in a supine posture for the following seven days.
- In mandibular dislocation, the region is fomented thoroughly, then the mandible is duly reduced to its appropriate position, and *Panchangi badha* is applied for support. *Ghrita* medicated with *Madhuka* (*Kakolyadi gana*) and *Vataghna* (*Chavyadi gana*) should be used for *Nasya*.
- In the case of a depressed nose, a thin capillary rod (*Shalaka*) is used to raise it; in the case of lateral displacement, it is straightened. Then, after dusting the nose with *Ghrita*, two hollow tubes should be placed into each nostril (to aid breathing).
- In case of torn Ear cartilage, *Ghrita* should be applied locally; then it should be brought to its natural position; then bandaging measures and remedial agents as in *Saddhyo vrana* are adopted for treatment.
- In case of Frontal bone fracture, which is not associated with any oozing of the brain matter, it should be bandaged with local application of Honey and *Ghrita* for further one week. After that, the patient must drink ghee for a week. In case of Traumatic contusions, the surgeon must locally apply medicated pastes or ointments. In case of Mal-united fractures: they are to be re-fractured, then appropriately reduced and treated appropriately.
- Fractures occurring in any bone in the upper part of the body, should be treated with *Sirobasti* (mentioned as '*Mastikya*'), *Karnapurana*, *Ghritapana* and *Nasya*. In the case of Old dislocations, the affected part is relaxed first by local lubrication with oleaginous substances and hot fomentation. After achieving the relaxation, it

should be reduced with an appropriate manipulative procedure. In case of any Warning against infection, a surgeon should exert a guard against advent of any pyogenic infection in a fractured bone. Due to suppuration of local muscles, vessels & ligaments; condition heads towards poorer prognosis of healing

#### 2.4 *Kapata Shayana Vidhi*

In case of the Tibia, Fibula, and Femur fracture; Acharya Sushruta has mentioned a unique immobilization method known as '*Kapata Shayana vidhi*'. In this method, the patient was made to lay down on a wooden plank or a wooden board and was bound to five pegs or stakes at five different places for immobilization of the affected limb. Placement of the pegs in each case should be as follows: in fracture of Femur: a pair of peg should be placed at either side of hip joint, another pair at either side of knee joint, a peg at sole of the foot; in case of fracture of Tibia, Fibula: instead of putting the pegs at hip joint, they should be placed at either side of ankle joint, rest of the pegs should be placed as previously mentioned. The same method is applied in case of fracture and dislocation of pelvic joint, vertebral column, chest, and shoulder joint<sup>17</sup>. Acharyas have mentioned these; the principle behind the procedure is immobilization of the affected limb. They thought of major fractures not being possible to immobilize by splints. Also, the fractures of these bones require immobilization for a longer period. So, they mentioned these procedures.

#### 2.5 *Local Applications and Measures*

*Parisekam* is the primary method used for pain and inflammation before the bandaging is done. In the predominance of *pitta* to promote union and to prevent suppuration, *nyagrodadhi kashayam* is used. In predominance of *vata*, associated with *pitta*, *laghu panchamula kashayam* is sprinkled<sup>18</sup>. In predominance of *vata* and *kapha*, *cakra tailam* is used for *parisekam*.<sup>19</sup> *Alepanam* is made with a mixture of *Manjista* (*Rubia Cordifolia*), *madhuka* (*Glycyrhiza Glabra*, *rakta Chandana* (*Pterocarpus santalinus*)), and flour of *Sali* (rice) mixed with ghee washed a hundred times. Acharya has also opined that *parisekam* and *alepanam* should be verily cold and be prepared with dosha alleviating drugs according to *kala* and *doshas*.<sup>20</sup> Oils of *trapusa* (*Cucumis Sativus*), *vibhitaka* (*Terminalia Bellerica*), *priyala* (*Buchanania Latifolia*) mixed with *vasa* (Muscle fat) should be cooked with the paste of *kakolyadhi* drugs along with ten times of milk. This oil is indicated for fracture union and can be administered in the form of *abyanga*, *nasya*, *basti*, *pariseka* or oral intake.<sup>21</sup> Acharya has also extensively explained the preparation of *Gandha tailam*, which is used for the fracture union. It can be administered in the form of *nasya*, *pana* or *basti*.<sup>22</sup> Bandaging is explained along with its importance. Bandaging intervals vary depending on the Ritu, for example, during the Grishma Ritu (summer), bandaging should be opened every third day, whereas in the Saumya Ritu, bandaging should be opened every seven days (cold season). In a moderately timed span of five days, one can open bandaging. If the bandage is too loose, the joint will not be stabilized; if it is too tight, inflammation, discomfort, and suppuration may occur. As a result, the bandage should be relatively tight.<sup>23</sup> *Ahara* and *vihara* have also been given great importance for wholesome management. Use of *lavana*, *katu* and *amla rasa*, alkaline foods, *ruksha ahara*, *atapa sevana*, *vyayama* delays the healing of fracture. *Sali* rice, meat soups, milk, ghee, pea soup, weight promoting foods, and drinks enhance the good quality of fracture healing. Acharya Sushruta advised drinking milk of

Primiparous Cow processed with *Ghrita*, drugs of *Madhura gana* and *Laksha*; daily, early morning for better healing.<sup>24</sup>

#### 2.6 *Sukhacheshtaprasarana*

Although no Ayurveda literature specifically addresses physical therapy or rehabilitation, Sushruta recommended physical therapy techniques for hand strengthening, such as grasping a lump of salt or earth. Similar to this, finger fractures should also undergo physiotherapy exercises. Bolstering the bone and soft tissues, is crucial for restoring the normal function of fingers. Rehabilitation, which involves returning patients to the best of their physical, mental, and social abilities, is given special attention nowadays and has evolved into a completely different field. The accomplishment of fracture stability, the prompt introduction of soft tissue mobilization, and the avoidance of post-surgical contracture are all necessary to successfully rehabilitate finger fractures. Therefore, in phalangeal fractures, attention should be paid to all three tissues (bone, soft tissue, and scar). For the control of edema, the R.I.C.E. method-rest, ice, compression, and elevation-is stressed. Exercises that improve grip strength, finger range of motion, and fist-making should be performed.<sup>25</sup>

#### 2.7 *Sadhyा Asadhyā*

Acharya Sushruta described the prognosis of fractures into *Sukhasadhyā*, *Kashtasadhyā* and *Asadhyā* after consideration upon the following points:

1. Prognosis,
2. Seasonal variations,
3. Age,
4. Status of the patient,
5. Site of the fracture,
6. Status of the bone,
7. Type of the Fracture.

Acharya Sushruta has mentioned that the cure takes place with extreme difficulty in *Choornita bhagna* (Comminuted fracture), *Chinna bhagna* (Incomplete fracture), *Atipatita bhagna* (Complete fracture), *Majjanugata bhagna* (Impacted fracture) and in Intra-articular fractures.

The fractures impacted in

1. Pediatric age group patients,
2. Frail and emaciated persons,
3. Individuals suffering from dermatological diseases, asthma, congenital anomalies and other supervening disorders,
4. A person with intemperate habits / *vatika* temperament / who is sparing in his diet – has a poor prognosis.<sup>26</sup>

**The following fractures have a guarded prognosis (*Asadhyā*):**

1. Complete fracture and dislocation of Pelvic bone with displacement,
2. Comminuted (*choornita*) fractures of iliac bone and frontal bone,
3. Dislocations of the cranial bones,
4. Fracture of Sternum, Temporal bone, Vertebral column and Cranium.

The bone or the joint which has a congenital anomaly, a diseased bone, fracture of bones which was reduced

appropriately but displaced due to improper immobilization or improper bandaging, or if the fractured part is disturbed – lead to failure of the treatment. The fractures treated by an expert surgeon get properly united if it occurs at the first three stages of life (childhood, adolescence, adult). The management of fractures is difficult in patients who consume excess *Lavana*, *Katu*, *Kashaya*, *Amla dravyas*; also in those who are involved in excess *Vyayama*, and excess *Maithuna*.

#### 2.8 Criteria for Samyaka Bhagna Sandhana (Clinical Features of Ideal Fracture Union)

A good clinical criterion of Bhagna Sandhana (fracture union) has been presented in the Sushruta Samhita, viz. There should be no pain or soreness, *Aheenangam* (no shortening) means no shortening or gaping, *Anulabnam* (no swelling or deformity) means no irregularity or swelling, and *Sukhchestaprasara* indicates complete and painless movements or complete functional recuperation.<sup>27</sup>

### 3. DISCUSSION

Surgery has been practiced in India since the prehistoric age, according to references in the Vedas, particularly orthopedic surgery such as prosthetic limb replacement, fixing of severed heads, which were performed by the physicians "Ashvini Kumars." However, it was at its pinnacle during the time of Sushruta, about the 5th century BC. Unique technical management approaches for Bhagna (skeletal injuries) have been described, including *Sthapna* (reduction), *Bandhana* (immobilization), and *Sukhchestaprasara* (physiotherapy - a component of rehabilitation). The essential management of fractures, right from reduction to rehabilitation which is followed in present-day orthopedics can be traced back to *Sushruta Samhita*. External applications of various *bhagna sthapana* drugs are also mentioned. Open surgical management

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of fractures has not been described. Sushruta has mentioned various drugs under *Nyagrodadhi*, *Ambastadhi* and *Priyangwadi gana* as *sandhaneeya* in *sutra sthan*.<sup>28</sup>

### 4. CONCLUSION

On the extensive study of *bhagna* and its management, it can be understood that acharya has given an extensive description on etiology and classification according to the clinical symptoms. Even without any radiological evidence, various types of fractures have not only been diagnosed but also have been treated systematically. Even though open surgical methods have not been mentioned, management of open fractures, assessment of proper union, methods of reduction, aligning and bandaging techniques have been scripted. Dietic indications, rate of curability of fractures according to age, and seasonal indications for changing bandages have also been explained. Along with the management of local sites, acharya has given a holistic approach.

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Dr.Devyani Dasar conceptualized and guided me throughout the whole compilation of the review article, Dr. Shubham Biswas helped in the curation of data and gave necessary inputs. Dr. Naveen Singh and Dr. Abhishek Mavale contributed in designing the manuscript.

### 7. CONFLICT OF INTEREST

Conflict of interest declared none.

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