

Review Article

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“BHAGNA (FRACTURES) IN AYURVEDA: SUSHRUTA’S PRINCIPLES OF FRACTURE MANAGEMENT AND THE EVIDENCE FOR BONE-HEALING HERBS SUCH AS ASTHISHRINKHALA”

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ABSTRACT

Background: Fractures are a major global cause of disability, and delayed union and non-union remain clinical challenges. Sushruta described fractures and dislocations (Bhagna) in detail, including their classification, reduction, immobilisation and rehabilitation, together with herbs believed to promote bone healing. Asthishrinkhala (*Cissus quadrangularis*), literally “bone chain”, is the best-known of these. **Objective:** To review Sushruta’s principles of fracture management, compare them with modern orthopaedic principles, and summarise experimental and clinical evidence for *Cissus quadrangularis* in fracture healing. **Methods:** Narrative review of Sushruta Samhita and of experimental studies, clinical trials and recent reviews. **Results:** Sushruta classified Bhagna into dislocations (Sandhimukta, six types) and fractures (Kandabhagna, twelve types) and described reduction by traction, pressure and manipulation, immobilisation with splints, and graded rehabilitation, closely paralleling modern principles. *Cissus quadrangularis* extract promoted proliferation of bone marrow mesenchymal stem cells and osteoblast differentiation in vitro. Early clinical observations in India suggested faster healing. Small randomised trials in mandibular and maxillofacial fractures reported reduced pain and swelling, earlier radiological healing and higher serum calcium and alkaline phosphatase with *Cissus quadrangularis*, without reported adverse effects. A 2026 review judged these studies small, heterogeneous and short-term. **Conclusion:** Sushruta’s fracture principles remain valid and *Cissus quadrangularis* is a promising adjunct to standard fracture care. Larger, well-designed trials in long-bone and osteoporotic fractures are needed. **KEYWORDS:** Bhagna; fracture; Kandabhagna; Sandhimukta; Asthishrinkhala; *Cissus quadrangularis*; bone healing; Sushruta

INTRODUCTION

Fractures are among the most common injuries worldwide. The Global Burden of Disease study estimated hundreds of millions of prevalent fractures and substantial disability from them, with a rising burden due to population ageing and osteoporosis^[1]. Osteoporotic fractures alone were estimated to affect about nine million people each year worldwide^[2]. Most fractures heal well with appropriate reduction and immobilisation, but a minority develop delayed union or non-union, which causes prolonged pain, disability and further surgery^[3,4].

Fracture healing is a complex biological process involving inflammation, formation of soft and hard callus, and remodelling. It requires mechanical stability, an adequate blood supply and appropriate biological signalling^[4,5]. Interest in agents that can accelerate healing, particularly in high-risk patients, is long-standing.

Sushruta, writing more than two thousand years ago, gave one of the earliest systematic accounts of fractures and dislocations. His principles of reduction, immobilisation and rehabilitation closely resemble modern practice. He also described herbs and diets believed to promote healing. Among these, *Asthishrinkhala* (*Cissus quadrangularis*) has attracted modern research. This review summarises Sushruta's approach and the evidence for *Cissus quadrangularis* in fracture healing.

METHODS

Classical sources were Sushruta Samhita, Nidana Sthana 15 (Bhagna Nidana) and Chikitsa Sthana 3 (Bhagna Chikitsa)^[6]. Modern literature was identified through PubMed, Google Scholar and the Digital Helpdesk of Indian Medicine using fracture healing, *Cissus quadrangularis*, *Asthishrinkhala*, Hadjod, bone, osteoblast and Bhagna. This is a narrative review.

SUSHRUTA'S CLASSIFICATION OF

BHAGNA

Sushruta divides Bhagna into two main groups^[6]:

Sandhimukta (dislocations): six types, described according to the displacement of the joint surfaces, such as Utpishta (crushed joint with swelling), Vishlishta (loosened joint), Vivartita (twisted joint), Avakshipta (displaced downwards), Atikshipta (displaced beyond) and Tiryakkshipta (displaced sideways).

Kandabhagna (fractures): twelve types, described according to the pattern of the fracture, for example Karkataka (with a swelling at the centre, resembling a crab), Ashvakarna (projecting like a horse's ear), Churnita (comminuted), Pichchita (crushed and flattened), Asthichhallita (with a splinter lifted from the bone), Kandabhagna proper, Majjanugata (impacted into the marrow), Atipatita (complete separation), Vakra (bent, as in greenstick fractures), Chhinna (separated on one side), Patita (with many fissures) and Sphutita (with cracks).

These categories correspond reasonably well to modern descriptive terms such as comminuted, impacted, greenstick and displaced fractures. Sushruta also lists general signs of fracture, including swelling, severe pain, abnormal mobility, crepitus and inability to bear weight, and specific features of each type.

Prognosis

Sushruta notes that healing depends on age, constitution and the type of fracture, and that fractures heal more quickly in the young and more slowly in the elderly^[6]. He identifies certain fractures as difficult to treat, including those of flat bones of the skull and fractures with severe displacement. This awareness of factors affecting healing is consistent with modern knowledge.

SUSHRUTA'S PRINCIPLES OF FRACTURE MANAGEMENT

Sushruta's management can be summarised in four steps, which parallel modern orthopaedic principles^[6]:

Table 1: Sushruta's principles of fracture management and modern parallels

Sushruta's principle	Description	Modern parallel
Anchana (traction)	Pulling the limb to restore length	Traction for reduction
Peedana (pressure)	Pressing displaced fragments into place	Manipulation
Sankshepa (apposition)	Bringing fragments together	Reduction and alignment
Bandhana (immobilisation)	Splinting with Kusha (bamboo or wooden strips) and bandages, with regular loosening and re-tightening	Splints, casts, fixation

He also describes:

- **Care during immobilisation:** splints should be loosened and re-applied periodically; the limb should be kept in a proper position; cold applications in the early stage and warm applications later.
- **Diet:** nourishing foods, milk, meat soup and ghee to promote healing; avoidance of salty, spicy and dry foods.
- **Medicines:** herbs taken orally and applied locally, including Laksha (lac), Arjuna, Asthishrinkhala and various medicated oils and ghees.
- **Rehabilitation:** gradual return to activity, exercise of the healed limb and oil massage.

Sushruta also describes specific techniques and bandages for fractures and dislocations at different sites^[6]. His emphasis on reduction, immobilisation and rehabilitation remains the foundation of fracture care today.

CISSUS QUADRANGULARIS (ASTHISHRINKHALA)

Description

Cissus quadrangularis is a succulent climbing plant of the grape family with four-angled, jointed stems, widely found in India. Its Sanskrit name Asthishrinkhala and Hindi name Hadjod both mean “bone joiner”. It is traditionally used both orally and as a poultice for fractures.

Experimental evidence

In an in vitro study, a petroleum ether extract of Cissus quadrangularis increased the differentiation of rat bone marrow mesenchymal stem cells into alkaline phosphatase-positive osteoblasts and increased extracellular matrix calcification; at the highest concentration, it also increased cell proliferation^[7]. Earlier experimental and animal studies in India also reported faster callus formation

and mineralisation.

Proposed mechanisms include stimulation of osteoblast differentiation, increased mineral deposition, anabolic effects related to its phytosterols and other constituents, and anti-inflammatory and analgesic effects that may reduce pain and swelling in the early stages after injury.

Clinical evidence

Early clinical observations in India reported faster healing of fractures in patients treated with Cissus quadrangularis^[8]. More recently, small randomised trials have been conducted, mainly in maxillofacial and mandibular fractures, where healing can be assessed relatively easily.

A 2026 review of Cissus quadrangularis in bone health summarised these studies^[9]:

- A randomised trial in 60 patients with mandibular fractures found that Cissus quadrangularis capsules led to better clinical and radiological healing, less pain, swelling and mobility, greater bite force and higher serum calcium and alkaline phosphatase compared with placebo, with no adverse effects reported^[10].
- A comparison of Ocimum sanctum, Cissus quadrangularis and placebo in 29 patients with mandibular fractures found shorter immobilisation time, higher serum calcium and alkaline phosphatase and greater bite force with Cissus quadrangularis^[11].
- A pilot randomised study in nine patients with maxillofacial fractures treated with open reduction and internal fixation found greater reductions in pain, swelling and fragment mobility and earlier callus formation on CT with Cissus quadrangularis added to standard care^[12].

The review concluded that the evidence is promising but limited by small, heterogeneous and short-term studies, without a standardised formulation^[9].

Table 2: Summary of clinical studies in Bhagna

Study	Population	Design	Main findings
Singh 2013 ^[10]	60 patients, mandibular fractures	RCT vs placebo	Better healing, less pain and swelling, higher bite force, higher calcium and ALP
Mohammad 2014 ^[11]	29 patients, mandibular fractures	Comparison with Ocimum and placebo	Shorter immobilisation, higher calcium and ALP, greater bite force
Brahmkshatriya 2015 ^[12]	9 patients, maxillofacial fractures after ORIF	Pilot RCT	Less pain and swelling, earlier callus on CT

Study	Population	Design	Main findings
Manocchio 2026 ^[9]	Review	—	Promising but small, heterogeneous, short-term studies

OTHER AYURVEDIC AGENTS USED IN BHAGNA

Besides *Cissus quadrangularis*, several other agents are commonly used in Ayurvedic fracture care:

- **Laksha (lac, a resin secreted by the insect *Laccifer lacca*):** a key ingredient of Laksha Guggulu, one of the most widely prescribed formulations for fractures, along with Arjuna, Ashwagandha and Nagabala. Sushruta recommends Laksha with milk for fracture patients^[6].
- **Arjuna (*Terminalia arjuna*):** used internally and externally for fractures; its bark is rich in calcium salts and tannins.
- **Guggulu (*Commiphora wightii*):** used as a vehicle and anti-inflammatory agent in many formulations.
- **Calcium-rich preparations:** formulations such as Pravala Pishti (processed coral) and Mukta Shukti Bhasma (processed pearl oyster) are used as sources of calcium. Their absorption and safety, including heavy metal content, should be confirmed by testing.
- **Topical applications:** pastes of Asthishrinkhala, Manjishtha and other herbs, and medicated oils such as Murivenna (a Kerala preparation used for injuries and swelling) and Mahanarayana Taila for massage after union.

None of these, apart from *Cissus quadrangularis*, has been tested in controlled clinical trials for fracture healing. Laksha Guggulu, being the most commonly prescribed classical formulation, is a priority for clinical evaluation.

REHABILITATION AND COMPLICATIONS

Sushruta advises gradual resumption of movement after healing and oil massage of the affected part^[6]. Modern rehabilitation similarly aims to restore range of motion, strength and function, and to prevent stiffness and muscle wasting. Ayurvedic Abhyanga with warm medicated oils, followed by gentle movement, can be integrated with physiotherapy after the fracture has united.

Sushruta also recognised complications of poor fracture care, such as malunion and stiffness, and

warned that improperly united bones may need to be broken and re-set. Modern complications to watch for include compartment syndrome, infection in open fractures, avascular necrosis at certain sites, complex regional pain syndrome and non-union^[3,4]. Ayurvedic practitioners treating fracture patients should be trained to recognise these and refer promptly.

ROLE OF AYURVEDA IN MODERN FRACTURE CARE

In many parts of India and elsewhere, traditional bone setters treat a large share of fractures. Studies from Africa and Asia have documented serious complications from traditional bone setting, including malunion, non-union, tight splinting leading to limb gangrene, and infection^[13]. This underlines the need to integrate traditional practices with modern diagnosis and treatment rather than replace them.

A responsible integrated approach would include:

1. **Diagnosis:** clinical assessment and X-ray, with further imaging when needed.
2. **Definitive care:** reduction and immobilisation by trained professionals, with surgical fixation when indicated.
3. **Ayurvedic adjuncts:** oral *Cissus quadrangularis* or classical formulations such as Laksha Guggulu, nourishing diet, and attention to Agni, used alongside standard care.
4. **Rehabilitation:** physiotherapy combined with Ayurvedic oil massage and gradual exercise after union.
5. **Monitoring:** clinical and radiological follow-up to detect delayed union early.

Particular attention should be paid to patients at risk of poor healing, such as older adults with osteoporosis, smokers, people with diabetes and those with open or comminuted fractures^[3,4].

SAFETY

Cissus quadrangularis was well tolerated in the reported clinical studies, with no adverse effects noted^[9-12]. However, safety data are limited, and interactions with drugs such as antidiabetic agents are possible. Commercial products vary in quality and dose. Topical poultices should not be applied over open wounds. Tight splinting or bandaging without

monitoring can cause compartment syndrome or gangrene and must be avoided.

DISCUSSION

Sushruta's account of fractures and dislocations is remarkable for its systematic classification and its principles of traction, reduction, immobilisation and rehabilitation, which remain central to orthopaedics. His recommendations to loosen and re-tighten splints periodically and to use cold followed by warm applications reflect practical clinical wisdom. *Cissus quadrangularis* is the most studied Ayurvedic bone-healing herb. In vitro studies support osteogenic activity, and small clinical trials in maxillofacial fractures report faster healing and better biochemical markers. These are encouraging results, but the trials are small, often single-centre and short, and outcomes vary. Long-bone fractures, osteoporotic fractures and non-unions, which are clinically more important, have not been adequately studied.

Future research should include: randomised, placebo-controlled trials of standardised *Cissus quadrangularis* extract in common fractures such as distal radius and tibial fractures, with time to radiological union as the primary outcome; studies in high-risk groups; pharmacokinetic and safety studies; and evaluation of classical formulations such as Laksha Guggulu.

CONCLUSION

Sushruta's principles of fracture management, including traction, reduction, immobilisation and rehabilitation, are consistent with modern orthopaedics. *Cissus quadrangularis* (Asthishrinkhala) shows osteogenic activity in vitro and promising results in small trials of maxillofacial fractures. It may be a useful adjunct to standard fracture care, but larger and more rigorous trials are needed before it can be widely recommended.

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