

## RECENT UPDATE ON PROFICIENT BONE FRACTURE REVIVIFYING HERBS

Singla Chhavi\*<sup>1</sup>, Drabu Sushma<sup>1</sup>, Verma Ravinder<sup>2</sup>, Dhiman Anju<sup>3</sup>, Sharma Asha<sup>4</sup><sup>1</sup>Maharaja Surajmal Institute of pharmacy, New Delhi, India<sup>2</sup>Nestle India Ltd, Kanpur, India<sup>3</sup>Department of Pharmaceutical Sciences, M.D.University, Rohtak-124001. Haryana. India<sup>4</sup>Department of Botany, M.D.University, Rohtak-124001. Haryana. India

Article Received on: 02/09/11 Revised on: 16/10/11 Approved for publication: 14/11/11

\*Email: chhavisingla01@gmail.com

## ABSTRACT

Fracture healing phenomenon is a complex process which involves cell and tissue differentiation and proliferation. Herbs influence rate of fracture healing by influencing the regeneration of connective tissue of mesenchymal origin viz. chondroblast, fibroblast and osteoblast that are involved in healing and quicker mineralization of callus. The present review highlights some of the potential herbs along with their application in healing bone fracture

**Keywords:** Chondroblast, fibroblast, fracture, osteoblast

## INTRODUCTION

Bone is a living material that is routinely exposed to mechanical environment which challenge its structural integrity. There are several causes of bone fractures. Bones can regenerate and form new osseous tissue where it is damaged or missing. In fact, healing of a fracture is one of the most remarkable phenomena of all the biological processes in the body<sup>1</sup>. Bones are the framework of an individual body and breakage may occur to any bone that makes up the body. There are basically two types of bone fracture: hairline or simple fracture and compound fracture. In case, when the skin is intact in the area of fracture, it is called 'simple fracture', and when skin breaks open due to broken bones it is known as 'compound fracture'.

A fracture may cause extreme pain and tenderness in the injured area, swelling, a protruding bone or blood under skin, numbness, tingling or paralysis below the fracture. A major fracture may also cause a loss of pulse such as of an arm or leg below the fracture as well as weakness and inability to bear weight. Most fractures are caused by an accident, but some occur because of tumors, osteoporosis, or deficiencies of vitamin D or calcium. Fracture symptoms include limb deformities, limited limb functioning, shortening of limb in fractures of long bones, pain, grating sensation (if the broken bone ends rub against each other), and swelling and discoloration of the skin overlying the fracture area. First-aid treatment for fractures should include covering any wound and immobilizing or splinting the broken part in its original position. Medical treatment involves repositioning the bone pieces in their normal position. Nutrients aid in healing process by growing a bridge of tissue composed largely of protein fibers across the ends of the broken bones. Calcium and phosphorus deposits among these protein fibers thereby form a new bone. Therefore, diet must be high in protein and adequate in calcium and phosphorus. Also, diet should be high in calories to provide the energy necessary for new bone cell formation<sup>2</sup>. Vitamin D intakes must be adequate because it is essential for maintaining normal blood levels of calcium. Vitamin K is used for healing bone fracture specifically in osteoporosis and postmenopausal woman. Calcium is known to decrease the incidence of bone fractures in postmenopausal woman, Potassium is required for cell formation, vitamin C is necessary for the maintenance and development of bones, and vitamin A helps to increase the rate of bone growth.

## MODE OF ALACRITY

Fracture healing includes cell and tissue differentiation and proliferation. This process involves inflammatory cytokines,

antioxidants, growth factors, bone building (osteoblast) and bone breaking (osteoclast) cells, amino acids, hormones and many nutrients.

The mode of alacrity in case of fracture healing may be divided into three phases:

- 1. The Inflammation Phase:** In fracture, a blood clot is formed which allows influx of inflammatory, clean –up cells to the area of wound, then cytokine cascade is started that brings the repairing cells into the fracture gap. These cells differentiate into specialized cells that build new bone tissue (osteoblast) and new cartilage (chondroblasts). These cells began the repair process and lays down new bone matrix and cartilage. At the beginning, the osteoclast cell dissolves and recycles the bone debris.
- 2. The Reparative Phase:** The reparative phase begins two weeks after the fracture occurs. During this phase, proteins produced by chondroblast and the osteoblast consolidate into soft tissue. This soft, new bone substance hardens into a hard callus as the bone weaves together over a 6-11 week time period
- 3. The Remodeling Phase:** In this stage, callus matures and remodels itself. Woven bone is converted into stronger lamellar bone by action of both osteoblast bone formation cells and osteoclast resorption cells.<sup>3</sup>

## PROFICIENT HERBS FOR BONE FRACTURE TREATMENT :

**1. *Ampelocissus latifolia*, (Vahl.) Planch.Syn. *Vitis latifolia* Roxb**

The roots and barks of *Ampelocissus latifolia*,(Vahl.) Planch.(Vitaceae) are used in the treatment of bone fracture, dysentery, fever and in menstrual complaints. The roots are also employed in the treatment of pain in stomach, snake bites, sores and wounds.<sup>4</sup>

**2. *Bambusa arundinacea* (Retz.)Roxb.**

*Bambusa arundinacea* (Retz.)Roxb (Gramineae), commonly known as 'bamboo', causes decrease in inflammation thereby helping in fracture healing. It has benzoic acid, traces of cyanogenic glycoside, and a siliceous substance 'tabasheer' which helps in fracture healing. It also has calcium, phosphorus and zinc. Oral or topical application of paste of stem or leaves is used for fracture healing. Aqueous extract of crushed leaves can also be used for bone healing.<sup>5</sup>

**3. *Bridelia Montana* Wild**

The bark and roots of *Bridelia Montana* Wild. (Euphorbiaceae) are used as astringent, antihelminthic and in the treatment of bone fracture. The root contains 5.7% tannins.<sup>6</sup>

**4. *Cissus quadrangularis***

The stem part of *Cissus quadrangularis* (Vitaceae) is considered to improve digestion and useful in piles, and used widely in healing of

fractures. The stem may be administered orally or applied topically to help heal fractures in dislocation and traumatic injury. The plant contains unsymmetrical tetracyclic triterpenes apart from  $\delta$ -amyrin and  $\delta$ -amyrone in the hexane extract. In addition, several alicyclic lipid constituent have also been reported. From the methanolic fraction, 3, 3', 4, 4'-tetrahydroxybiphenyl has been isolated. The plant contains calcium oxalate, vitamin C (398 mg per 100g fresh, tender stem) and  $\beta$ -carotene. In clinical practice, in patients of jaw-bone fractures, it was found that addition of *Ocimum santum* and *Cissus quadrangularis*, along with the usual management of fracture was found to reduce the period of immobilization significantly.<sup>7</sup>

#### 5. *Coelogyne cristata* Lindl.

*Coelogyne cristata* Lindl. (Orchidaceae) has osteosynthesis stimulatory property due to its astringent and haemostatic action and presence of various trace minerals. It contains mainly calcium, phosphorous, zinc and  $\beta$ -sisterol.<sup>8</sup>

#### 6. *Coriandrum sativum* Linn.

*Coriandrum sativum* Linn. (Apiaceae) has an astringent and aphrodisiac action, which might have activated the release of sex hormones resulting into accelerated healing process. It contains high amount of calcium, phosphorus, oxalic acid, vitamin A, B and C, iron, protein and fats. It heals chronic ulcers, rheumatism, swelling, neuralgia, bleeding piles etc. It is used orally as finely grinded fresh leaves or powder of dried seeds.<sup>9</sup>

#### 7. *Symphytum officinale* Linn. (Knit bone)

*Symphytum officinale* Linn. (Boraginaceae) removes the inflammation surrounding the fracture. It induces union of affected parts and contains allantoin, a crystallizable substance used in orthodox medicine to encourage epithelial formation in ulcer and wound.<sup>10, 11</sup>

#### 8. *Colubrina asiatica* Brongn

Leaves of *Colubrina asiatica* Brongn. (Rhamnaceae) are used to treat bone fracture. An infusion of leaves may be used in obstetric conditions. The seed oil has antibacterial potential against a number of bacterial strains. It also possesses hypotensive, antispasmodic and cardiac depressant effects in experimental animals. The fruit part is reported to possess antifertility property and decoction of the fruit is used as an abortifacient. The leaves contain saponin, colubrinoside and colubrine. The saponin present in the plant leaves show strong sedative activity. The seeds yield a pale yellow essential oil (2.1%).<sup>12</sup>

#### 9. *Salvia miltiorrhiza* (Dan Sheng)

*Salvia miltiorrhiza* (Lamiaceae) causes early formation of

dense callus, and microscopic examination has also revealed the increased activity of osteoblast. Dan shen could improve mandibular bone fracture. Dan shen was used in an experimental group of rabbit with induced bone defects; it increases osteoblast activity to greater extent and also stimulates synthesis of protein in fibroblast.<sup>13</sup>

#### 10. *Ehretia cymosa*

The leaf poultice of *Ehretia cymosa* (Boraginaceae) is used to cover fractured area or for joint dislocation. The healing is accelerated as compared to no treatment. In a clinical trial to test bone remodeling potential, there was 112% increase in bone turnover using aqueous extracts of *E. cymosa*.<sup>14</sup>

#### 11. *Griffonia simplicifolia*

Roots and leaves of *Griffonia simplicifolia* (Leguminosae) are used to treat bone fracture. It is also used in congestion, as sedative, aphrodisiac and appetite suppressant for weight loss.<sup>15</sup>

#### 12. *Equisetum species* (Horse-tail)

Horse-tail (*Equisetaceae*) contains a considerable amount of calcium and other constituents. It is believed to be useful in the healing of the bone fracture and connective tissue injury. The plant also contains silica, an abrasive compound that makes horsetail an excellent pot scrubber, for hair rinse or facial scrub. Horse tail tea is used by herbalist as a urinary tract cleanser and it is often used in the treatment of urinary tract infections.<sup>16</sup>

#### 13. *Saraca asoca* (Roxb.)

The bark of *Saraca asoca* (Caesalpinaceae) is bitter, astringent, refrigerant, anthelmintic, styptic, stomachic, febrifuge, demulcent and used in constipation. It is also used in dyspepsia, fever, dipsia, burning sensation, visceromegaly, colic, ulcers, menorrhagia, metropathy, leucorrhoea and pimples. The dried flowers are used in diabetes and haemorrhagic dysentery and seeds are used for treating bone fractures, strangury and vesicle calculi.<sup>17</sup>

#### 14. *Terminalia arjuna* (Roxb.) Wight & Arn.

*Terminalia arjuna* (Combretaceae) contains tannins, arjunic acid, arjunantin, calcium carbonates and sodium chloride. The bark has haemostatic property. Powder of bark is used orally for bone fracture treatment.<sup>8, 18</sup>

#### 15. *Vitex negundo* L.

The leaves of *Vitex negundo* (Lamiaceae) are employed in the treatment of body ache, headache, colic, cough, cold, eczema, bone fracture, ulcer and tooth ache. A pillow stuffed with the leaves is placed under the head to relieve headache.<sup>4</sup>

Table 1 enlists some medicinal plant species, in traditional system of medicine, currently being used as proficient bone revivifying herbs.

**Table 1.** List of some medicinal plant species used as proficient bone revivifying herbs are enlisted below

S. No.	Botanical Name	Part Used	Reference (s)
1.	<i>Alangium salvifolium</i> (Alangiaceae)	Leaves and bark are used for healing bone fracture	4
2.	<i>Amorphophallus cam.</i> Panulates (Araceae)	Leaf extract is used in preparation of medicated oil for bone fracture	19
3.	<i>Angiopteris evecta</i> (Forst.) Hoffm. (Angiopteridaceae)	Stem and leaves paste applied for bone fracture	20
4.	<i>Bambusa tulda</i> Roxb. (Bambusaceae)	Stem and leaves paste applied for bone fracture	20
5.	<i>Angelica atropurpurea</i> (Apiacea)	Poultice of roots applied to heal broken bones, and whole plant or roots used internally, externally or in a steam bath to treat rheumatism	14
6.	<i>Angelica venenosa</i> (Apiacea)	Poultice applied to sprained muscles and twisted joints	14
7.	<i>Aralia racemosa</i> (Araliaceae)	Root decoction and poultice applied to heal sprains, strained muscles, and fractures	14
8.	<i>Buxus wallichiana</i> Baill. (Buxaceae)	Bark paste is applied locally	21
9.	<i>Calotropis gigantea</i> (Linn.) R.Br.ex Ait. (Apocynaceae)	Roasted leaves are bandaged locally	22
10.	<i>Caryopteris odorata</i> (Ham.) B.I. Robinson (Lamiaceae)	Wood paste applied as paste	21
11.	<i>Cassia occidentalis</i> L. (Fabaceae)	The plant parts are used for healing bone fracture	16
12.	<i>Cicuta maculate</i> (Apiacea)	Decoction of plant is used to treat bruises, sprains, sore joints or broken bones	14

13.	<i>Curcuma domestica</i> Valetton syn. <i>C. longa</i> Linn. (Zingiberaceae)	Root powder paste with ghee applied locally	23
14.	<i>Debregeasia salicifolia</i> (Urticaceae)	Bark paste and wood splints are applied locally	21
15.	<i>Desmodium ovalifolium</i> (Leguminosae)	Whole plant	24
16.	<i>Dipsacus species</i> (Dipsacaceae)	Promotes bone healing process	25
17.			
18.	<i>Dodonaea viscosa</i> Linn. (Sapindaceae)	Leaf paste with egg albumin and lime are applied to aid in bone setting	26
19.	<i>Drynaria species</i> (Polypodiaceae)	Whole plant promotes bone healing process	25
20.	<i>Fraxinus xanthoxyloides</i> (G.Don.)DC. (Oleaceae)	The bark is an esteemed cattle medicine. The decoction of the stems/twigs is applied to wound and bone fractures	27
21.	<i>Girardinia heterophylla</i> Decne (Urticaceae)	Root and leaf plaster is applied locally	21
22.	<i>Grewia optiva</i> Drummond (Tiliaceae)	Bark paste is applied as plaster	21
23.	<i>Jatropha gossypifolia</i> Linn. (Euphorbiaceae)	Root extract is given orally	28
24.	<i>Lepisorus bicolor</i> (Polypodiaceae)	Rhizome paste plaster kept for 3-4 weeks	29
25.	<i>Malva neglecta</i> (Malvaceae)	Cold infusion of leaves applied as poultice to heal broken bones and decoction of plants applied as poultice to baby's sore back	14
26.	<i>Moringa oleifera</i> Lam. (Moringaceae)	Bark paste is applied locally	30
27.	<i>Murraya paniculata</i> Linn. (Rutaceae)	Leaves pounded with egg albumin are applied as a plaster	31
28.	<i>Osyris wightiana</i> Wall. Ex Wight (Santalaceae)	Root paste is plastered for 2-3 weeks	29
29.	<i>Pinus roxburghii</i> Sarg. Pinaceae	Resin is applied as plaster	21
30.	<i>Pinus wallichiana</i> A.B Jackson Pinaceae	Bark paste is applied as plaster	21
31.	<i>Polygonatum officinale</i> All. (Liliaceae)	Root extract given orally. This extract contains allantoin, a substance well known for its healing and anti-inflammatory effects	21
32.	<i>Prunus cerasoides</i> (Rosaceae)	Fresh bark paste is applied as plaster	21
33.	<i>Quercus bicolor</i> (Fagaceae)	Bark decoction is used to treat fractures	14
34.	<i>Rostellularia prostrata</i> (Roxb.) Acanthaceae	Paste of plant used in sprain and bone fracture and also in snake-bite	32
35.	<i>Senecio aureus</i> (Asteraceae)	Plant decoction is used to treat fractures	14
36.	<i>Sida acuta</i> Burm. (Malvaceae)	Leaf paste along with white egg yolk is applied	31
37.	<i>Taxus wallichiana</i> Planch. (Taxaceae)	Bark paste is applied locally	21
38.	<i>Tinospora cordifolia</i> (willd.) hook (Menispermaceae)	Stem paste is used as bandage for treatment of bone fracture and dislocation of bones	18
39.	<i>Thumbergia coccinea</i> (Acanthaceae)	Paste is applied for the treatment of bone fracture	33
40.	<i>Ulmus Americana</i> (Ulmaceae)	Bark decoction is used to heal broken bones	14
41.	<i>Ulmus wallichiana</i> Planch (Ulmaceae)	Bark paste is applied locally	21
42.	<i>Urgenia indica</i> Kunth (Hyacinthaceae)	Bark paste is applied locally	21
43.	<i>Uvularia perfoliata</i> (Liliaceae/ Uvulariaceae)	Plant used variously externally and internally to treat fractures	14

## CONCLUSION

Medicinal plants constitute an effective source of traditional and modern medicines.<sup>34</sup> Traditional herbal medicines have been the integral part of medical practice. The long tradition of herbal wisdom has employed various herbs to speed fracture healing. Natural medicinal products are now favorite among therapeutic substances in the West and drawing attention of scientists and pharmaceutical companies. Phytopharmacotherapy for bone and fracture healing is expected to be safe when compared with synthetic drugs in terms of side effects, therefore, use of botanicals must be promoted for this problem and research must be promoted for isolation of active molecules, from effective therapeutic herbs for bone fracture healing.

## REFERENCES

- Doblare M, Garcia JM, Gomez MJ. Modelling bone tissue fracture and healing: a review. *Engineering Fracture Mechanics* 2004;71:1809-1840.
- Krischmann JD. *Nutritional Alumanac*. Nutrition Search, Inc. 2007;6<sup>th</sup> ed:174-175.
- Marsh DR, Li G. The biology of fracture healing: optimizing outcome. *British Medical Bulletin* 1999;55(4):856-869.
- Vardhana R. *Direct Uses of Medicinal plant and their identification* 2008: 1<sup>st</sup>ed.: 380.
- Asgar A. Studies on osteogenesis under the influence of *Bambusa arundinacea* and *Cissus quadrangularis*-*Uraria picta*-*Lepidium sativum* on radius-ulna fracture in dogs [dissertation]. Pantnagar (India); 1999.
- Khare CP. *Indian Medicinal plants: An illustrated dictionary*. 2007: 101
- Premila MS. *Ayurvedic Herbs: a clinical guide to healing plants of traditional Indian medicine* 2006: 219.
- Singh H. *Terminalia arjuna* and *Coelogyne cristata* in the repair of canine fracture [dissertation]. Pantnagar (India); 1995.
- Singh H, Jadon MS, Sharma VK, Singh SP, Gupta RS, Kumar S. Research on some aspects of bone and joint affections in animals (1998) Directorate of experiment station, Agriculture & technology, Pantnagar; 1998.
- Roberts M. *A-Z of herbs*. 2000:35.
- Leyel. *Compassionate Herbs*. 2008:10.

- Pulliah T. *Encyclopedia of world medicinal plant*. 2006, Vol 5: 620
- Wynn SG, Foughe B. *Veterinary Herbal Medicine*. 2007: 347.
- Lewis WH, Elwin- Lewis MPF. *Medicinal Botany: plants affecting human health*. 2003, 2nd Ed: 244.
- Odugbemi T. Outline and pictures of medicinal plants from Nigeria. 2006: 94
- Tilford GL. *Edible and medicinal plants of the west*. 2009, 11<sup>th</sup> Ed.: 76.
- Warrier PK, Nambiar VPK, Ramankutty C, Nair RV. *Indian Medicinal plants: a Compendium of 500 species*. 1966; Volume 5.
- Bora PJ, Kumar Y. *Floristic diversity of Assam*. 2003; 28.
- Anonymus. *Handbook on herbs cultivation and processing*. 2004; 49.
- Pandey HN, Baek SK, Tripathi OP. *Ecology, diversity and conservation of plants and ecosystem in India*, 2006: 407.
- Gaur RD, Bhatt KC and Tiwari JK, An ethnobotanical study of Uttar Pradesh Himalaya in relation to veterinary medicines. *Indian Bot Soc* 1992; 72: 139-144.
- Chettri R, Rai B, Khawas DB. Certain medicinal plants in the folklore and folklife of Darjeeling and Sikkim Hills. *J Econ Taxon Bot* 1992; 10: 393-398.
- Mondal MK and Chauhan JPS, A survey of ethno-veterinary medicine practices in West Bengal. *Indian J Vet Med* 2000; 20(1): 90-91.
- Batugal PA, Kanniah J, Lee SY, Oviler JT, *Medicinal plants research in Asia*, 2004; Vol 1: 122.
- Xie H, Preast V. *Xie's Chinese veterinary herbology*. 2010, 1<sup>st</sup> Ed.: 343
- Sudarsanam G, Reddy MB and Nagaraju N, *Veterinary crude drugs in Rayalaseema, Andhra Pradesh, India*. *Int J Pharmacogn* 1995; 33: 52-60.
- Chauhan NS. *Medicinal and aromatic plants of Himachal Pradesh*. 1999. 536
- Sebastian MK and Bhandari MM, Some plants used as veterinary medicines by Bhils. *Int J Trop Agric* 1984; 2(4): 307-310.
- Bhattarai NK, Folk use of plants in veterinary medicine in central Nepal *Fitoterapia* 1992; 63: 497-506.
- Mondal MK, Chauhan JPS. A survey of ethno-veterinary medicine practices in West Bengal, *Indian J Vet Med* 2000; 20(1): 90-91.
- Sudarsanam G, Reddy MB, Nagaraju N. *Veterinary crude drugs in Rayalaseema, Andhra Pradesh, India*. *Int J Pharmacogn* 1995; 33: 52-60.
- Pullaiah T, Ramakrishnaiah V, Rani SS, Rao PN. *Flora of Guntur district Andhra Pradesh India*: 2000: 272- 32.
- Tandon P, Abrol YP, Kumaria S. *Biodiversity and its significance*, 2007: 250
- Dhiman A, Lal R. *Phytochemical and Pharmacological status of Datura fastuosa* Linn. *Int J Res Ayur Pharm* 2011;2(1):145-150.