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Ayurvedic intervention as an adjunct therapy in Non-union 5th metatarsal fracture: A case report

Research Article

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Abstract

Proximal 5th metatarsal (MT) fractures are a common sequel of foot injury and painful nonunion is one of its well-described consequences. The purpose of this study is to present the manifestation and determine the effectiveness of *ayurvedic* healing measure for symptomatic 5th MT non unions. Here we narrate a case study presented with the painful nonunion of 5th metatarsal bone following failure of conventional management. The subject was investigated for following parameters: (1) injury mechanism; (2) time to solid radiographic union; and (3) time to resume usual activities. The subject was monitored until there was a clear clinical and radiological union. The mechanism of injury in this case was a fall over forefoot with plantar flexion, inversion and abduction. The nonunion was demonstrated in radiograph even after 3 months of fracture. "*Sarivadi lepa"* (therapeutic application of drug) was used as external application and bandaging to reduce pain, inflammation, and compliment healing process of the fracture along with immobilisation. By the end of 60 days, radiograph showed evidence of callus formation and solid radiographic union was demonstrated. The subject resumed to his usual activities after complete union and maintained well till last follow up. Thus, we can claim that *Sarivadi bandhana* (bandaging) is beneficial in subsiding pain, swelling and to facilitate healing of fracture along with immobilisation. We recommend further study on *Sarivadi Lepa* in larger sample to establish its assistance in fracture healing action.

Keywords: *Ayurveda,* Nonunion, 5th MT Fracture, *Bhagna, Sarivadi lepa*.

Introduction

According to statistics, metatarsal fractures account for about 5-6% of all foot injuries (1). The fifth metatarsal fracture represents 68% of all metatarsal fracture, is the most prevalent (2). Metatarsal fractures in adults occur between the second and fifth decade of life (2). Due to decreased blood supply to the distal metatarsal, its healing is usually delayed or may result in complete painful non healing (1). The line of management for non-union fracture may be surgical or non-surgical. The surgical procedure generally adopted is biological enhancements and mechanical process. The evidence suggests that non-surgical method is ineffective in short bones especially in weight bearing joint (3). Ayurveda classics suggest a wide range of simple to sophisticated methods of treatment for fracture cases that promote fracture healing and facilitate callus formation. The Ayurvedic approach has traditionally incorporated bone reduction, immobilisation, as well as physical manoeuvres (4). Classically, fracture healing may be facilitated by the external and internal application of numerous herbal medications alongside immobilisation and bone reduction (5). The results of Ayurveda therapy in the fracture management specially in non-union fractures is less recognised in public domain and its effectiveness is less understood even by the general Ayurvedic practitioners. Keeping these facts in mind, we decided to publish the case to bring into light the outcome of Ayurveda therapy in non-union of 5th MT fracture and to promote awareness among population.

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Patient Information

A 50-year-old male with no significant medical history presented with severe pain, swelling on the dorsum of left foot, and inability to weight bearing; after sustaining a fall from steps with the twisted forefoot. The very first day (11/11/2021) he consulted an orthopaedic expert and on examination, there was swelling and tenderness on palpation on dorsum of left foot at 5th metatarsal bone. The left foot radiograph showed a fracture at left 5th metatarsal bone (Figure 1). Therefore, immobilisation was done with cast and was advised with non-steroidal anti-inflammatory drugs (NSAIDs), antacids, calcium and vitamin D supplements and complete rest for 6 weeks (11/11/2021-23/12/2021). For one week, the subject appreciated reduction in symptoms, hence stopped NSAIDs. But in the second week, he observed that the

cast was not holding and the pain was continuous and severe enough to substantially affect daily activities. On 11th day (23/11/2021), the pain became intolerable, and compelled the subject to repeat the radiography which showed complete detachment of 5th metatarsal bone (Figure 2). Thereafter the subject consulted orthopaedic expert again and the cast was reapplied. He was advised rest again for 6 weeks. This time the subject followed the same instructions carefully and was immobilised for 8 weeks (23/11/2021- 10/1/2022). Soon after, on 17/1/2022 cast was removed, supported with the crepe, and was advised light physical activities. After completion of the treatment period, on 16/4/2022 the subject again developed pain and swelling at the site of fracture for which, the subject underwent radiographic evaluation again. It showed non-union/healing of 5th MT fracture and fibrotic changes (Figure 3). Therefore, he consulted three orthopaedic surgeons for expert opinion but each professional suggested surgical intervention as the only option. The subject was reluctant to undergo surgical method of fracture management, and hence he started Ayurveda therapy.

Clinical Findings

The subject had a BMI of 25 and was a vegetarian. General examination: No pallor, icterus, cyanosis, clubbing, lymphadenopathy, or any other abnormality was detected. All systemic examination parameters were found to be within normal limits. On systemic examination, bilateral normal vesicular breath sound, S1 and S2 heart sounds were heard, and the subject was conscious, well oriented with intact memory.

On local examinations of left foot, **s**welling at dorsum of foot on inspection with tenderness in palpation was recorded. The range of movement was restricted due to pain and as a result, the subject was unable to bear his own weight. There was no swelling seen in and around ankle joint.

Diagnostic Assessment

The evaluation for symptom reduction was graded, and the VAS Scale was used to assess pain (Table 1). Further radiological assessment is presented in Figure 1, Figure 2, and Figure 3 after obtaining informed patient consent.

Table 1: Assessment criteria

Clinical presentation	10.5.2022 Baseline Value	20.5.2022 FU-1	23.6.2022 FU-2	13.7.2022 FU-3	13.8.2022 FU-4
Pain (VAS SCORE)	SCORE 5	SCORE 0	SCORE 0	SCORE 0	SCORE 0
Tenderness	Grade 3	Grade 0	Grade 0	Grade 0	Grade 0
Swelling	Grade 1	Grade 0	Grade 0	Grade 0	Grade 0

VAS: Visual analog scale. Tenderness Assessment criteria: Grade 0- No Tenderness; Grade 1- Patient whine pain; Grade 2- winces; Grade 3- winces and withdraws; Grade 4-Does not allow to touch Swelling Assessment criteria: Grade 0-No Swelling; Grade 1- mild; Grade 2- moderate; Grade 3- Severe. FU: Follow Up

Therapeutic Intervention

The main aim of the treatment principle was to reduce pain, swelling, inflammation and augment healing process. Initially, "*Sarivadi lepa*" (therapeutic application of paste) was applied over the fracture area for 5 hours every day one month, which alleviated local swelling, and pain (Figure 4). The radiograph showed no difference in fractured bone (Figure 5). Therefore, "*Sarivadi Lepa Bandhana*" (bandaging) was planned by applying the *lepa* (anointment) over the fracture site in the *pratiloma* (reversre) direction of local hair. Subsequently, it was tightened with a cotton bandage and placed in immobilisation for 3 days. The thickness of the *lepa* (anointment) was approximately 0.5 centimetres. By means of a warm water irrigation process, the bandage was replaced every fourth day. In this way, the procedure was repeated eight times in a 30-day period. The summary of the intervention is depicted in the Table 2.

Table 2: Summary of intervention

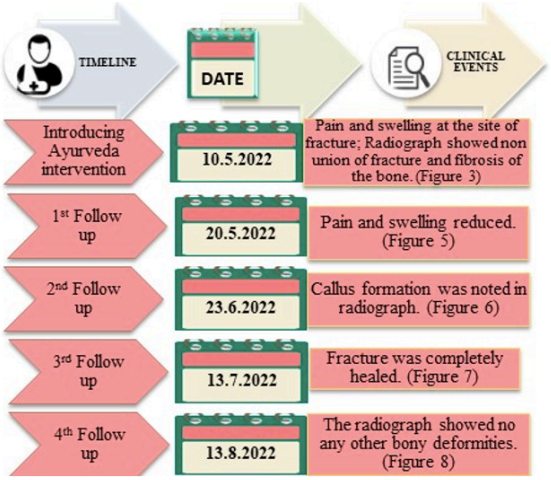
Duration of treatment	Drug used	Dosage	Rationale of drug
60 days	*Krishna Sariva (Ichnocarpus frutescens* (L.) W.T.Aiton*) Devdaru (Cedrus* deodara (Roxb.) G.Don*) Amragandhi Haridra (Curcuma amada* Roxburgh*) Shirisha (Albizia lebbeck* (L.) Benth.*) Medasaka (Litsea glutinosa* (Lour.) C.B.Rob*) Bola (Commiphora myrrha* (Nees) Engl.*) Mayaphal (Quercus infectoria* Oliv.*) Suddha guggul(Commiphora mukul* (Stocks) Hook.*) Tila taila (Sesamum indicum* L. oil*)*	External application Quantity Sufficient	Anti-inflammatory Antinociceptive Facilitate Fracture healing

Timeline

In the present case, the effect of *Sarivadi lepa bandhana* was seen from Day 10, and the radiograph showed initiation of healing process (Figure 6). In 30 days of *Sarivadi Lepa bandhana*, the radiograph showed demonstrable changes (Figure 7). There was complete healing of fracture in the shaft of 5th metatarsal bone. The x ray illustrated no evidence of any other bony deformities one month after treatment free period (Figure 8). The complete timeline is displayed in the Figure 9.

Figure 1: First day of Fracture	Figure 2: After two weeks of fracture	Figure 3:After conventional management of fracture	Figure 4:*Sarivadi Lepa* Ingredients
			
Figure 5:*On Sarivadi Lepa* application (Before starting *Sarivadi Lepa Bandhana*)	**Figure 6:After 10 days of *Sarivadi Lepa Bandhana***	**Figure 7:At the end of *Sarivadi Lepa Bandhana***	**Figure 8: After treatment free period of one month (Follow Up 4)**
			

Figure 9: The timeline of the case and outcomes



Follow up and outcome

With the application of *Sarivadi Lepa*, the subject saw a substantial improvement in their symptoms. The radiographic union was seen at the end of thirty days *Sarivadi lepa bandhana* and the subject resumed working soon after. The subject was followed up for one more month, during this treatment free period he was maintaining well and there was no relapse of fracture. No adverse symptoms were noted during treatment period. The Ayurveda remedy was found to be safe and effective. Periodical improvements were recorded with radiographs and shown in Figure 6, 7, and 8.

Discussion

Non-union has been attributed to a number of factors, which can be categorized into two main categories: injury characteristics and treatment-related factors. Treatment related factors include fracture type, use of non-steroidal anti-inflammatory drugs (NSAIDs), delayed weight bearing, mechanical instability, and patient-related factors are age and sex, body mass index (BMI), obesity, smoking, alcohol, and medical history of diabetes, hypertension, and osteoporosis6. In the present case, the mechanism of injury was a fall over forefoot with plantar flexion, inversion and abduction, subsequently leading to spiral fracture of shaft of 5th MT bone. The repeated radio graphic investigation showed a radiolucent resorption gap around the fracture, thus confirming nonunion of fracture 3 months after the onset of symptoms. The subject is biologically stable, thus rules out systemic causes. Although there are several contributing components, the precise mechanism for a nonunion of 5th MT is not fully understood. In the present case, the acute trauma to the foot and erroneous immobilization would have resulted in its non-union.

In Ayurveda, skeletal injuries are considered *Bhagna* (fracture), specifically, *padatala bhagna* (fracture metatarsal) (8). The classics of Ayurveda offers a variety of integrated approaches for treating fracture cases that contribute callus formation and fracture healing. The Ayurvedic method has traditionally encompassed A*nchana karma* (Traction), *Pidana* (applying pressure), *Sankshepa* (Apposition), and *Bandhana* (Bandaging) (8). This approach involves the external and internal administration of several herbal remedies which accelerates fracture healing. For this purpose, Acharya Sushruta advised using *Alepa* (anointment with moderate thickness) and *Parisheka* (therapeutic streaming), to reduce pain and inflammation (8). The present case study signifies the

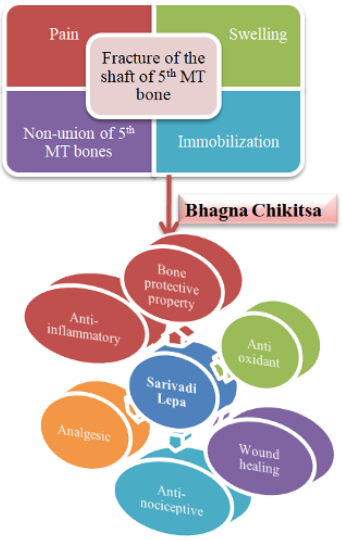
relevance of Ayurveda fracture management following the nonunion of 5th MT fracture healing. The fundamental therapeutic strategy is to normalize the abnormal *Dosha* (regulatory functional factors of the body) at the fracture site. According to fundamental principle, pain and oedema are caused by increased *Vata* and *Kapha Dosha*, which are predominant in the area surrounding the broken bone (9). The "*Sarivadi Lepa*" has various pharmacological and biological characteristics that mitigate these abnormal *dosha*. The majority of the ingredients of *Sarivadi Lepa* have *Tikta* (bitter taste), *madhura* (sweet taste), and *Kashaya rasa* (astringent taste); *laghu* (lightness), *Rooksha* (dryness) *guna* attribute); *Ushna virya* (hot potency) and *Katu vipaka* (bio-transformed *rasa)* with *Bhagna sandhanakara* (fracture binding), *Shothahara* (anti-inflammatory) and *Shoolahara* (anti-spasmodic) properties.(10) Traditionally, *Commiphora myrrha*, *Quercus infectoria*, *Curcuma amada*, *Listea glutinosa* are the main ingredients of various classical and proprietary medicines that are used in strengthening the bones, joints and in fracture healing *such as "Asthi sandhanaka Lepa",(11) "Bonton Tablets",(12) "Gandha Taila,(13) etc.* *Tila taila* is known to effectively strengthen the bone, heal fracture by virtue of its *yogavahi* (carrier of properties) property (14).

According to modern pharmacological studies, various polysaccharides of herbal medicines have been validated for their pharmacological activities in tissue repair. *Ichnocarpus frutescens*, *Cedrus deodara*, *Curcuma amada*, *Albizzia lebbeck*, *Listea glutinosa*, *Commiphora myrrha, Quercus infectoria*, *Commiphora mukul* are few to name. The bioactive compounds derived from these have exhibited various therapeutic benefits on bone health. The polyphenolic extract of roots of *I. frutescens* possesses a significant anti-oxidant activity (15). The volatile oil in *Albizzia lebbeck,(16) Listea glutinosa,(17) Cedrus deodara,(18) etc* exhibits analgesic, anti-inflammatory, antinociceptive and wound healing property. In specific, terpenoids in *Curcuma amada* alleviates the inflammation due to injury (19). *Quercus infectoria* acts at the tissue level, repairs tissue, and demonstrate anti-inflammatory, wound healing property (20). The effectiveness of *C. mukul* and *C. myrrha* in bone fracture is evident in analytical and clinical study. The results of the study revealed that the methanol extract of *C. mukul, (21)* and polysaccharides of *C. myrrha* has bone protective property and prevents bone resorption as well as a considerable increase in bone strength resulting in a nearly complete restoration of bone microarchitecture (22). External application of *Listea glutinosa, Ichnocarpus frutescens, Curcuma amada,* have been traditionally used extensively in bone fracture, sprain, bruises, and arthritis (23). They are also used in septic dressing of wounds; the paste is applied over the site of fracture and covered with the cloth to fasten healing (24). It works by promoting early fracture re union, reducing pain and inflammation, improving blood supply to the fracture site.

The mechanism of *lepa* is similar to percutaneous absorption, such as trans-follicular, pilo-sebaceous absorption and trans-dermal drug delivery. Here, the active pharmaceutical ingredients get absorbed in *Romakupa* (hair follicles), diffuse into the bloodstream, and act on the pathology. The absorption further enhances when the vehicle of administration is in lipid form (25). In the present case, direct action of fracture binging property of *guggulu*; *shoolahara* and *shothahara* action of all the ingredients with *sookshma* (penetrating), *vyavayi* quality (substances with quick spread even without digestion) of *tila taila* along with *yogavahi* (carrier of properties) might have helped the active ingredients of all the constituents' drugs to reach site of action quickly, thus alleviating all the symptoms and aiding union of fractured bone.

Simple Ayurvedic measure to promote healing resulted in recovery. The effective, affordable, and simple Ayurvedic treatment in the form of external application is responsible for the positive outcomes in the current case. Figure 10 illustrates potential action of Ayurvedic measure to promote healing and their potential targets. The subject gave his opinion about the care he received over 60-day period of treatment. He stated that having followed the Ayurvedic treatment, the painful foot, trouble walking, swelling, and non-union of the fracture had all been completely relieved. The patient also said that no discomfort was felt during entire period of external application of the prescribed compound.

Figure 10: Rationale of Ayurveda measure to promote healing in 5th MT fracture



Conclusion

The nonunion of the fracture has been observed as one of the common complications nowadays by the clinicians, which is in the 5th MT fracture in the present case. This common problem has been successfully treated by a simple Ayurvedic remedy without using any internal medication. Immobilization is pivotal measure followed in the management of fracture by both Indian and western system of medicine. The Ayurvedic remedy only aided in fast healing of this non healed fracture and did not cause any discomfort or disadvantage. The observation of this case would encourage clinical uses,

and research in Ayurveda fracture management. Further, simple Ayurvedic remedy may be suggested as an adjunct in fracture management.

References

1. Chloros G.D, Kakos C.D, Tastsidis I.K, Giannoudis V.P, Panteli M, Giannoudis P.V, Fifth metatarsal fractures: an update on management, complications, and outcomes. EFORT Open Rev. January, 2022; 7(1);13-25
2. Bowes J, Buckley R, Fifth metatarsal fractures and current treatment. World. J. Orthop. December, 2016; 7(12);793-800.
3. Bui D.T, Pym A.J, Lunz D, Ling J.S, Non-union in a neck of fifth metatarsal fracture: A case report. Trauma Case Rep. November, 2018; 18; 37-41.
4. Sharma S, Sharma S, Singh M, Fracture management principles in ayurveda with current interpretation: A review. Int. J. Res. Ayurveda Pharm. July-August, 2016; 7(4): 14-19.
5. Murthy S K R, Sushruta Samhita of Acharya Sushruta. 1st edition. Varanasi; Chaukhambha Sanskrit Series; 2002. 48–50p.
6. Quan K, Xu Q, Zhu M, Liu X, Dai M, Analysis of Risk Factors for Non-union After Surgery for Limb Fractures: A Case-Control Study of 669 Subjects. Front. Surg. December, 2021; 8; 754150.
7. Barnds B, Heenan M, Ayres J, Tarakemeh A, Schroeppel J.P, Mullen S, *et al*. Comparison of the rate of delayed/nonunion in fifth metatarsal fractures receiving anti-inflammatory medications. J. Exp. Orthop. December, 2021; 8(1); 115.
8. Murthy S K R, Sushruta Samhita of Acharya Sushruta. 1st edition. Varanasi; Chaukhambha Sanskrit Series; 2002. 47p.
9. Attanayake A.M.H.S, Jayaweera J.A.A.S, Kubukgolla W.W, De Silva U.M.G.D, Assessment of the outcome of Ayurvedic treatments for vertebral fracture with motor dysfunction. Ayu. January-March, 2018; 39(1):16-20.
10. Anonymous. The Ayurvedic Pharmacopoeia of India, Government of India, Ministry of Health and Family Welfare, Dept. of ISM and Homoeopathy, New Delhi; 2001
11. Anonymous, The Ayurvedic Formulary of India, Part II, (Department of Indian System of Medicine and Homoeopathy, New Delhi), 2003, 9(1).
12. Soni H.K, Kandachia J.M, Jani D.K, Patel G.R, Pharmacological investigation of bonton capsule for anti-osteoporotic activity in ovariectomized rat. Int. J. Pharm. Phytopharmacological Res. 2013; 3(1); 52-6.
13. Murthy K R, Astanga Hridaya of Vagbhata, 6th edition. Varanasi; Chaukhamba Krishnadas Academy; 2012. 284p
14. Anonymous, The Ayurvedic Formulary of India, Part II, (Department of Indian System of Medicine and Homoeopathy, New Delhi), 2003
15. Kumarappan C.T, Thilagam E, Mandal S.C. Antioxidant activity of polyphenolic extracts of Ichnocarpus frutescens. Saudi J Biol Sci. July, 2012; 19(3); 349-55.
16. Balkrishna A, Chauhan M, Dabas A, Arya V, A Comprehensive Insight into the Phytochemical, Pharmacological Potential, and Traditional Medicinal Uses of Albizia lebbeck (L.) Benth. eCAM. April, 2022; 2022; 19
17. Srivastava B, Sharma V.C, Verma S.C, Singh R, Jadhav A.D. Plant part substitution in *Litsea Chinensis* for medicinal use: A comparative phytochemical approach. Ancient Sci Life. October, 2017; 37(2); 57-62.
18. Akansha B, Smita J, Apoorva M, Jaya D, Sarvesh P, Swapnil S, Cedrus deodara (Roxb. ex D.Don) G.Don: A review of traditional use, phytochemical composition and pharmacology, J. Ethnopharmacology, October 2021; 279; 114361.
19. Policegoudra R.S, Aradhya S.M, Singh L, Mango ginger (Curcuma amada Roxb.) – A promising spice for phytochemicals and biological activities. J. Biosci. September, 2011; 36; 739-48.
20. Chokpaisarn J, Chusri S, Amnuaikit T, Udomuksorn W, Voravuthikunchai S.P. Potential wound healing activity of *Quercus infectoria* formulation in diabetic rats. Peer J. July, 2017;5; e3608.
21. Khan S, Dwivedi C, Parmar V, Srinivasan K.K, Shirwaikar A. Methanol extract of dried exudate of Commiphora mukul prevents bone resorption in ovariectomized rats. Pharm Biol. October, 2012; 50(10); 1330-6.
22. Hwang Y.H, Lee A, Kim T, Jang S.A, Ha H, Anti-Osteoporotic Effects of Commiphora Myrrha and Its Poly-Saccharide via Osteoclastogenesis Inhibition. Plants (Basel). May, 2021; 10(5); 945.
23. Santhosh K.J.U, Krishna C.M.J, Semotiuk A.J, Krishna V. Indigenous knowledge on medicinal plants used by ethnic communities of South India. Ethnobot. Res. Appl. February 2019; 18; 1-12.
24. Ratnam K.V, Raju R.V. Traditional medicine used by the adivasis of eastern ghats, Andhra Pradesh-for bone fractures. Ethnobotanical leaflets. 2008; 12; 19-22.
25. Sanath Kumar T, Shrilata, Niranjan A, Muraleedhran A.K: Efficacy of two ayurveda regimen in mild scorpion sting: an open-label, two-arm, clinical trial. Int J Pharm Sci & Res. August, 2021; 12(8); 4260-66.

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