Use of Focused Shock Waves in an Acute Talar Head Fracture

Osvaldo Valle[1]

Abstract

Talar fractures are rare and can be difficult to manage. Even in the absence of complications, the treatment of this type of injury can be prolonged and uncomfortable for the patient. Focused shock waves have been shown to be effective in the treatment of delayed unions and non-unions. In this case report, we share our experience with the use of focused shock waves in an acute talus fracture in a patient with risk factors for healing.

Keywords: Talus, Talar fractures, Shock waves, Bone marrow edema

Introduction

Talar fractures represent only 0.85% of all body fractures [1]. Fractures localized in the talar head are even rarer and have been associated with high complication rates [1, 2]. About two-thirds of the talus is covered with cartilage limiting the periosteal blood supply. Another peculiarity is the absence of tendinous insertions. The anatomical characteristics of this bone can frequently lead to complications of its fractures such as avascular necrosis and non-unions [3, 4]. Even in the absence of complications, the treatment of this type of injury can be prolonged and uncomfortable for the patient.

Focused shock waves have been shown to be effective in the treatment of delayed unions and non-unions due to their ability to generate upregulation and expression of various pro-angiogenic and pro-osteogenic growth factors, stimulating bone healing [5]. Although in most studies focused waves have been used in cases of fracture healing failure, their use has also been proposed in acute injuries [6]. In this case report, we share our experience with the use of focused shock waves in a talus head fracture in a patient with risk factors for healing.

Case Report

A 52-year-old female patient, with a history of epilepsy and chronic arterial hypertension, both under treatment, height 153 cm and weight 85 kg (body mass index of 36.3), severe asthma with use of oral and inhaled corticosteroid therapy, hypovitaminosis D in supplementation, and no smoking habit, was received in consultation.

On April 01, 2024, she slipped on a wet surface, complaining pain on the medial aspect of the left ankle, and limitations in axial load. Inspection revealed edema and diffuse ecchymosis on the anterior and medial aspects of the ankle.

Initial ankle radiographs did not demonstrate any acute traumatic injury. Given the persistence of symptoms, it was decided to evaluate the area with magnetic resonance imaging (MRI) on April 17, 2024. MRI demonstrated extensive bone edema of the talus, with the presence of a trabecular subchondral fracture at the level of the talar head (Fig. 1).

Taking into consideration the patient's underlying pathologies: Grade II obesity according to the World Health Organization criteria, therapy with systemic corticosteroid and hypovitaminosis under treatment; extracorporeal focused shock waves application was decided to accelerate the healing process and reduce bone marrow edema.

A BTL 6000 piezoelectric device was used. Five sessions were carried out with a weekly interval, 3000 impacts per session, with an energy density flux of 0.31 mJ/mm2 (70% level of energy in BTL devices) with a frequency of 10 Hz.

The following therapeutic measures were added: ambulation with total unload with the use of two Canadian canes and rehabilitation to maintain joint range of motion, proprioception exercises, and strengthening of extrinsic and intrinsic muscles, also without load.

A follow-up MRI was performed on June 03, 2024, which demonstrated complete resorption of the bone edema and total healing of the talar trabecular fracture (Fig. 2).

Discussion

Fractures of the talar head, including osteochondral fractures are rare, they account for 2.6–10% of all talus fractures [4]. The natural history of talar head fractures is largely unknown, as only case reports are published in the literature [4]. The literature on talar head fractures is limited [2]. Orthopedic treatment of talus fractures is prolonged over time: The non-displaced fractures of the head and body can be treated by casting the foot and ankle in a neutral position for 6 weeks.

[1]Department of Orthopedic Surgeon Surgery, Ankle and Foot Team, MEDS Clinic, Santiago de Chile;
President of ACHITOC (Chilean Association of Tissue Engineering and Shock Waves)

Address of Correspondence
Dr. Osvaldo Valle,
Department of Orthopedic Surgeon, Ankle and Foot Team, MEDS Clinic, Santiago de Chile;
President of ACHITOC (Chilean Association of Tissue Engineering and Shock Waves).
E-mail: tovato@gmail.com

Dr. Osvaldo Valle

Submitted Date: 04 Jun 2024, Review Date: 14 June 2024, Accepted Date: 20 Jun 2024 & Published: 30 June 2024

Journal of Regenerative Science | Available on www.jrsonweb.com | DOI:10.13107/jrs.2024.v04.i01.129

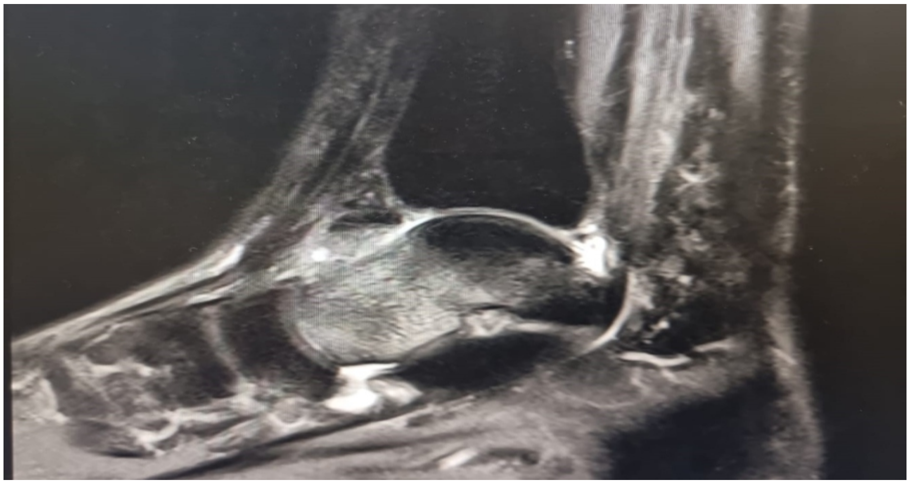

Figure 1: Subchondral fracture at the level of the talar head and extensive bone edema of the talus.

Partial weight bearing is required for approximately 8–10 weeks until radiographic proof of union of the fracture is obtained [7].
The talus is 60–70% covered in articular cartilage and has no muscular attachments [8]. The head of the talus is completely covered by cartilage.
The blood supply of the talus has a tenuous, unique, and delicate pattern, with several vessels contributing, but all of them are of low caliber; the predominantly cartilaginous surface greatly limits the available regions for perforating perfusion [4].
The rate of non-union is highly variable, with rates ranging from 3% to 20% [9, 10, 11]. Talus non-union or malunion are poorly tolerated, given the bone's multiple joint articulations, and its role as the cornerstone of weight transfer between the tibial and foot [4].
The patient in the case presented had risk factors for developing complications [12].

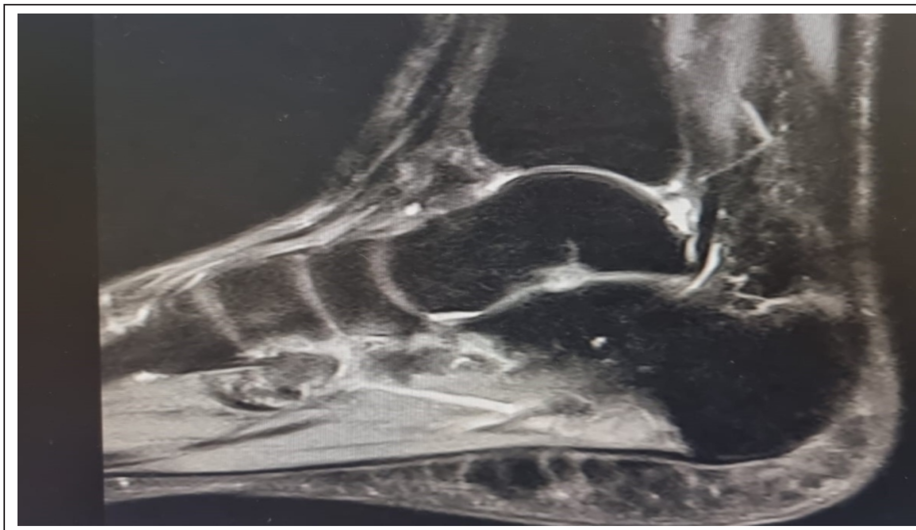

Figure 2: Resonance image after the application of focused shock waves.

She was obese, under corticosteroid therapy, and suffered hypovitaminosis D in supplementation at the time of initial consultation.
There is a large literature on the relationship between obesity and bone. The increasing body weight causes an increase in bone mineral density (BMD), both due to a mechanical effect and due to the greater amount of estrogen present in adipose tissue [13]. However, despite an apparent strengthening of the bone evidenced by increased BMD, the risk of fracture is greater. The increased risk of fracture in obese subjects is due to various factors [13]. These factors can be divided into metabolic alterations and increased risk of falls. The rate of fracture union is also compromised [13].
The effect of corticosteroids in terms of decreasing bone matrix density is well known [14]. Hypovitaminosis D predisposes to the occurrence of fractures [15, 16].
Wang et al. demonstrated that shockwaves generate upregulation and expression of various pro-angiogenic and pro-osteogenic growth factors, stimulating bone healing [5, 17]. This same author proposed the acute use of focused waves in acute high-energy fractures with a high risk of non-union in a randomized controlled trial [6]. At 12 months, the rate of non-union was 11% for the study group versus 20% for the control group [6].
Considering the characteristics of the patient and the injury and in light of Wang's experience, we decided to use shock waves in this case of talus fracture.

Conclusion

The use of focused shock waves in the present clinical case allowed, in our opinion, to accelerate the time and ensure the total healing of the talar fracture in a patient with risk factors for delay or non-union. It was possible to maintain a rehabilitation process throughout the treatment period, unlike the usual orthopedic procedure.

Declaration of patient consent: The authors certify that they have obtained all appropriate patient consent forms. In the form, the patient has given his consent for his images and other clinical information to be reported in the Journal. The patient understands that his name and initials will not be published, and due efforts will be made to conceal his identity, but anonymity cannot be guaranteed.

Conflicts of Interest: Nil. **Source of Support:** None.

References

1. Caracchini G, Pietragalla M, De Renzis A, Galluzzo M, Carbone M, Zappia M, Russo A, Greco F, Miele V. Talar fractures: radiological and CT evaluation and classification systems. Acta Biomed. 2018 Jan 19;89(1-S):151-165. doi: 10.23750/abm.v89i1-S.7019. PMID: 29350644; PMCID: PMC6179081.

2. Anderson MR, Flemister AS, Ketz JP. Operative Treatment of Talar Head Fractures: Surgical Technique. J Orthop Trauma. 2018 Aug;32(8):e334-e338. doi: 10.1097/BOT.0000000000001178. Erratum in: J Orthop Trauma. 2019 Oct;33(10):e409. doi: 10.1097/BOT.0000000000001596. PMID: 29664882.

3. Pradhan A, Najefi A, Patel A, Vris A, Heidari N, Malagelada F, Parker L, Jeyaseelan L. Complications after talus fractures: A trauma centre experience. Injury. 2023 Feb;54(2):772-777. doi: 10.1016/j.injury.2022.12.013. Epub 2022 Dec 15. PMID: 36543737.

4. Schwartz AM, Runge WO, Hsu AR, Bariteau JT. Fractures of the Talus: Current Concepts. Foot Ankle Orthop. 2020 Feb 13;5(1):2473011419900766. doi: 10.1177/2473011419900766. PMID: 35097362; PMCID: PMC8697161.

5. Moya D, Ramón S, Schaden W, Wang CJ, Guiloff L, Cheng JH. The Role of Extracorporeal Shockwave Treatment in Musculoskeletal Disorders. J Bone Joint Surg Am. 2018 Feb 7;100(3):251-263. doi: 10.2106/JBJS.17.00661. PMID: 29406349.

6. Wang CJ, Liu HC, Fu TH. The effects of extracorporeal shockwave on acute high-energy long bone fractures of the lower extremity. Arch Orthop Trauma Surg. 2007 Feb;127(2):137-42. doi: 10.1007/s00402-006-0236-0. Epub 2006 Oct 13. PMID: 17053946.

7. Vallier HA. Fractures of the Talus: State of the Art. J Orthop Trauma. 2015 Sep;29(9):385-92. doi: 10.1097/BOT.0000000000000378. PMID: 26299809.

8. Higgins TF, Baumgaertner MR. Diagnosis and treatment of fractures of the talus: a comprehensive review of the literature. Foot Ankle Int. 1999 Sep;20(9):595-605. doi: 10.1177/107110079902000911. PMID: 10509689.

9. Jordan RK, Bafna KR, Liu J, Ebraheim NA. Complications of Talar Neck Fractures by Hawkins Classification: A Systematic Review. J Foot Ankle Surg. 2017 Jul-Aug;56(4):817-821. doi: 10.1053/j.jfas.2017.04.013. PMID: 28633784.

10. Ohl X, Harisboure A, Hemery X, Dehoux E. Long-term follow-up after surgical treatment of talar fractures: Twenty cases with an average follow-up of 7.5 years. Int Orthop. 2011 Jan;35(1):93-9. doi: 10.1007/s00264-009-0930-y. Epub 2009 Dec 22. PMID: 20033158; PMCID: PMC3014484.

11. Vallier HA, Nork SE, Barei DP, Benirschke SK, Sangeorzan BJ. Talar neck fractures: results and outcomes. J Bone Joint Surg Am. 2004 Aug;86(8):1616-24. PMID: 15292407.

12. Zura R, Mehta S, Della Rocca GJ, Steen RG. Biological Risk Factors for Nonunion of Bone Fracture. JBJS Rev. 2016 Jan 5;4(1):e5. doi: 10.2106/JBJS.RVW.O.00008. PMID: 27490008.

13. Rinonapoli G, Pace V, Ruggiero C, Ceccarini P, Bisaccia M, Meccariello L, Caraffa A. Obesity and Bone: A Complex Relationship. Int J Mol Sci. 2021 Dec 20;22(24):13662. doi: 10.3390/ijms222413662. PMID: 34948466; PMCID: PMC8706946.

14. Liu SH, Cerri-Droz P, Ling K, Loyst RA, Wang KE, Tsouris N, Komatsu DE, Wang ED. Chronic Steroid Use, Complications, and Readmission Following Open Reduction Internal Fixation of Distal Radius Fracture. J Hand Surg Glob Online. 2023 Aug 19;5(6):757-762. doi: 10.1016/j.jhsg.2023.07.007. PMID: 38106944; PMCID: PMC10721537.

15. Moonen L, Gorter E, Schipper I. The importance of vitamin D in treatment of fracture non-union: A case report. Nutrition. 2021 Jul-Aug;87-88:111192. doi: 10.1016/j.nut.2021.111192. Epub 2021 Feb 10. PMID: 33761443.

16. Lips P, van Schoor NM. The effect of vitamin D on bone and osteoporosis. Best Pract Res Clin Endocrinol Metab. 2011 Aug;25(4):585-91. doi: 10.1016/j.beem.2011.05.002. PMID: 21872800.

17. Wang CJ, Wang FS, Yang KD. Biological effects of extracorporeal shockwave in bone healing: a study in rabbits. Arch Orthop Trauma Surg. 2008 Aug;128(8):879-84. doi: 10.1007/s00402-008-0663-1. Epub 2008 Jun 17. PMID: 18560855.

Conflict of Interest: NIL
Source of Support: NIL

How to Cite this Article

Valle O | Use of focused shock waves in an acute talar head fracture | Journal of Regenerative Science | Jan-Jun 2024; 4(1): 24-26.