



Contents lists available at ScienceDirect

International Journal of Surgery Case Reports

journal homepage: www.casereports.com

Calcaneal fracture with a concomitant unstable subtalar dislocation: A case report

Khalil T. Khalil^a, Mohammad O. Boushnak^{b,*}, Mohamad K. Moussa^b, Salar P. Jafar^a, Alain Akiki^a

^a Department of Orthopedic Surgery, Military General Hospital, Beirut, Lebanon

^b Orthopedic Surgery, Lebanese University, Faculty of Medical Sciences, Beirut, Lebanon

ARTICLE INFO

Article history:

Received 15 February 2021

Received in revised form 11 March 2021

Accepted 12 March 2021

Available online 19 March 2021

Keywords:

Subtalar dislocation

Synthetic graft

Subtalar instability

Calcaneo-fibular ligament

ABSTRACT

BACKGROUND: Traumatic dislocation of the subtalar joint is an infrequently occurring injury, first described by DuFaurest in 1811. They were later on classified by Broca as medial, lateral, posterior and anterior dislocations based on the direction of the dislocation.

CASE REPORT: We present a case of a 30 year old male who presented after a 5 m height fall and direct right foot trauma. Investigations done in the emergency department revealed a right subtalar lateral dislocation with associated calcaneal intraarticular displaced fracture. Open reduction internal fixation of the calcaneal fracture was decided alongside with reduction of the subtalar joint. Intraoperatively the subtalar reduction was totally unstable due to the deficiency of the lateral collateral ligament. A decision of reconstruction of the calcaneofibular ligament using a synthetic ligament was taken. This reconstruction resulted in an adequate intraoperative stability of the subtalar joint. On a 2 year follow up the patient was asymptomatic with no residual subtalar instability.

DISCUSSION: These injuries must be suspected after high energy trauma or twisting forces in the foot. They occur more frequently in men than in women and predominately affect people in their mid-30's. Our case is unique in that the reconstruction of the calcaneofibular ligament was done using a synthetic graft to stabilize an acute unstable subtalar joint dislocation.

CONCLUSION: Subtalar dislocation is a rare injury with post reduction instability being even rarer. Care has to be taken not to overlook the frequently associated bony injuries, due to their impact on treatment decision and prognosis.

© 2021 Published by Elsevier Ltd on behalf of IJS Publishing Group Ltd. This is an open access article under the CC BY-NC-ND license (<http://creativecommons.org/licenses/by-nc-nd/4.0/>).

1. Introduction

Subtalar dislocations are rare injuries; they account for 1%–2% of all dislocations and 15% of all peritalar injuries. They are caused by high-energy injuries, or twisting forces in the foot such as a fall from a height or road traffic accidents [1–3]. They mainly affect men in their mid-30's [4,5]. This injury is defined as a simultaneous dislocation of the subtalar (talocalcaneal) and talonavicular joints without any tibio-talar or calcaneocuboid joints involvement or associated talar neck fractures [5–7].

In 1811, Judey and DauFaurest reported the first 2 cases of subtalar dislocations termed: luxatio pedis subtalo[3,5,7]. Later on, in

1853, Broca introduced the first classification of subtalar dislocation based on the direction of the dislocation: medial, accounted for 72–80% of the cases, lateral, present in 17–26% and posterior present in 1–2.5% [3,5]. In 1856 Malgaigne and Burguer adjusted this classification by adding the anterior dislocation that is present only in 1% of the cases [5,7].

Although subtalar joint dislocation is a rare injury, rarity is attributed to the presence of a strong ligament connecting the talus and the calcaneus [6]. Prompt evaluation and treatment are required because of the high potential of long term complications that can be associated with such injuries [6]; these include stiffness, avascular necrosis, arthritis and instability. Instability is caused by the malfunction of the interosseous and the anterior talofibular ligaments [8]. We describe a case of subtalar lateral dislocation with associated calcaneal intraarticular displaced fracture complicated by acute intra-operative subtalar instability.

This case was reported in line with the SCARE criteria [9].

* Corresponding author at: Department of Orthopedic surgery, Lebanese University, Faculty of Medical Sciences, Beirut, Lebanon.

E-mail addresses: Khaliltkhalil@hotmail.com (K.T. Khalil), mohammadboushnak@hotmail.com (M.O. Boushnak), mhamadmoussa71976798@gmail.com (M.K. Moussa), salarpourjafar@gmail.com (S.P. Jafar), akiki.md@hotmail.com (A. Akiki).



Fig. 1. AP, Lateral and Axial views of the ankle joint showing calcaneal fracture with a sustentaculum tali fragment (blue arrow) with periarticular incongruity.



Fig. 2. Coronal and sagittal views of the ankle CT scan showing intraarticular calcaneal fracture (Sander's type II), cortical avulsion at the inferolateral aspect of the talus (blue arrow) and frank lateral subtalar dislocation (yellow arrow).

2. Case presentation

A 30 year old male patient previously healthy with no past medical or surgical history was brought to our emergency department for severe pain and swelling of the right ankle and foot after a fall from a 5 m height and direct right foot and ankle trauma. The initial trauma screening revealed a hemodynamically stable patient with no neurological compromise. Right ankle examination revealed a swollen ankle with severe calcaneal tenderness, no neurovascular compromise. No other associated injury was detected. Right foot and ankle antero-posterior and lateral radiographs (Fig. 1) showed a calcaneal fracture at the level of the sustentaculum tali with periarticular incongruity.

A CT scan was ordered for further clarification of the situation (Fig. 2) it revealed a comminuted intraarticular calcaneal fracture, Sander's type II, a small cortical avulsion at the inferior aspect of the talus and an associated lateral subtalar dislocation.

After discussion of the treatment options, an open reduction internal fixation of the calcaneal fracture was decided alongside with reduction of the subtalar joint. We performed a lateral approach through which we reduced the dislocation and we fixed the calcaneal fracture after adequate reduction. During the intraoperative testing, we found that the subtalar joint was highly unstable where it kept subluxating laterally with inability to maintain the reduction. This instability was attributed to the deficiency of the lateral collateral ligament where the subtalar joint was opening widely with varus stress. The classical technique for stabilization of the subtalar joint is by transarticular k-wire fixation but an intraop-

erative decision of reconstruction of the calcaneofibular ligament using a synthetic graft was taken and the reconstruction was performed. This resulted in an adequate intraoperative stability of the subtalar joint.

A short leg posterior splint was applied for 6 weeks, then gentle mobilization and weightbearing was allowed. Post operative x rays (Fig. 3) showed a fully congruent subtalar joint after fixation of the fracture and reconstruction of the lateral ligamentous complex using the synthetic graft. At 3, 6, 12 and 24 month follow ups, the patient was asymptomatic and he showed no signs of residual instability or any other complication. A foot and ankle MRI (Fig. 4) was performed at 2 years post operatively and showed adequate quality of the reconstructed calcaneo-fibular ligament.

3. Discussion

The subtalar joint is a gliding synovial joint [3] formed by the talus superiorly and the calcaneus and navicular bones inferiorly [6,7]. It is divided by the strong talocalcaneal ligaments in the sinus tarsi and the tarsal canal into two parts, an anterior and a posterior part [5]. Anteriorly, the talar head is located on the anterior and middle facets of the calcaneus, forming the acetabulum pedis with the posterior surface of the navicular bone (the talocalcaneonavicular joint) [5,6].

Subtalar joint movement can be described as rotation, translation or a combination of both that occurs around a single joint axis to produce inversion/eversion, abduction/adduction, and flexion/extension [4,7]. The subtalar joint axis of motion goes obliquely

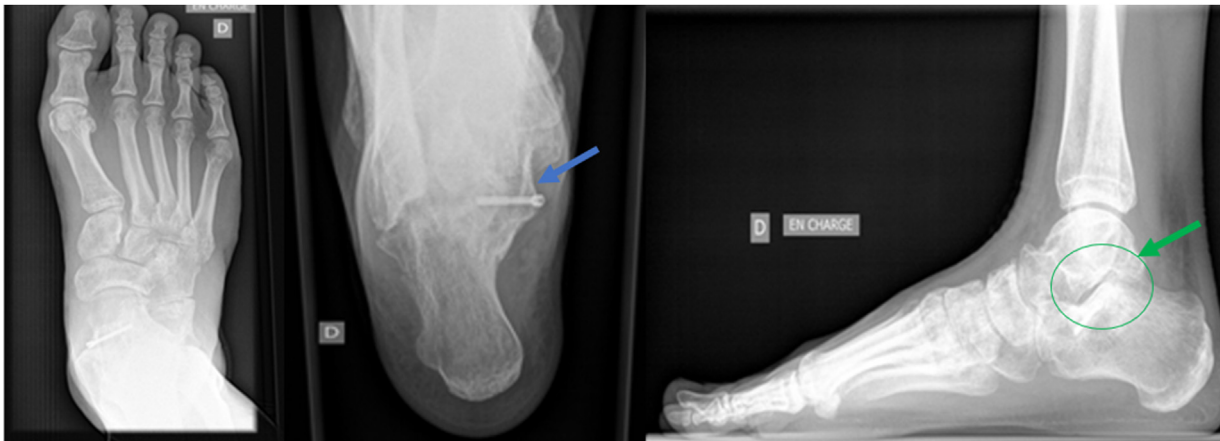


Fig. 3. Post-operative AP, lateral and axial x rays showing the fixation of the sustentaculum tali fragment (blue arrow) and complete congruency of the subtalar joint (green circle and arrow).

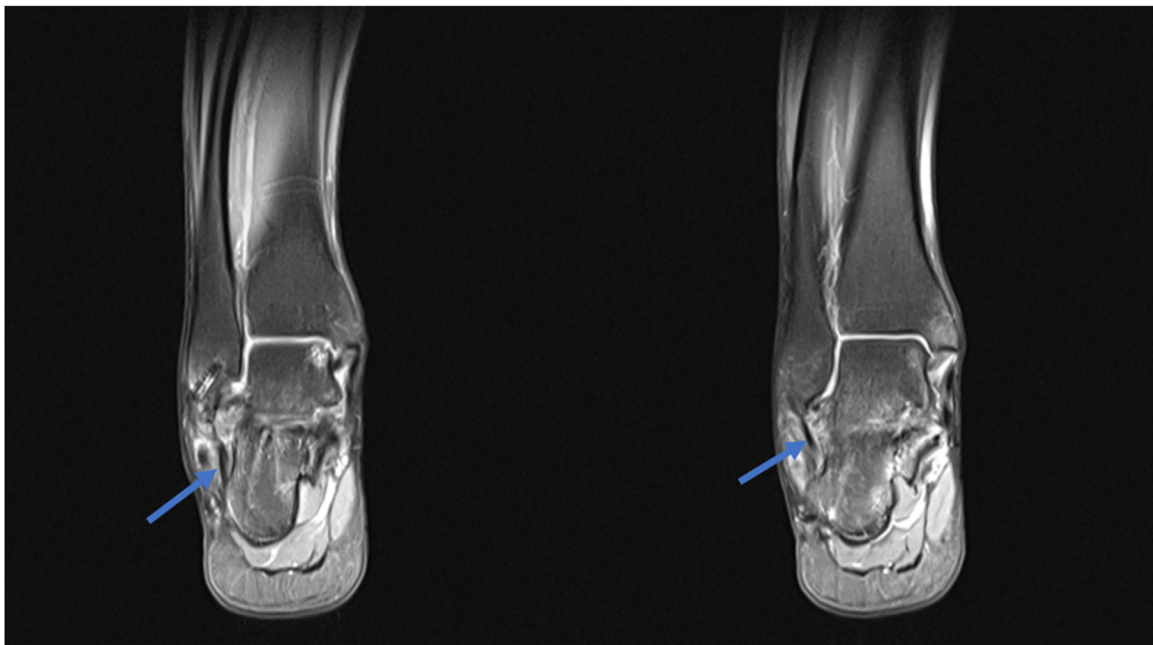


Fig. 4. Coronal views of a 2 year follow up MRI of the right ankle showing the continuity of the synthetic graft running from the distal pole of the fibula to the calcaneus simulating the calcaneofibular ligament (blue arrows).

from a posterior, plantar, and lateral position to an anterior, dorsal, and medial position [7].

The ligaments around the subtalar joint can be distinguished as intrinsic (cervical ligament, interosseous talocalcaneal ligament) and extrinsic ligaments (calcaneo-fibular ligament, tibio-calcaneal part of the deltoid ligament) [3]. The interosseous ligaments are believed to be the most significant ligaments in stabilizing the subtalar joint in addition to their important role in proprioception [3,6,8]. Adding further extrinsic support, are the tibio-calcaneal portion of the deltoid ligament and the calcaneofibular ligament which provide stability to both the ankle and subtalar joints [3,5,6,8,9]. Therefore, Etiologies for subtalar instability include mainly the malfunction of the cervical ligament, the CFL, the deltoid and the ITCL which are the major ligaments involved in the subtalar dislocations [4,6].

Subtalar joint dislocation is a very uncommon injury that accounts for approximately 1–2% of all joint dislocations [11]. Isolated dislocations are uncommon but associated fractures have often been described and care has to be taken not to overlook

them [12]. It involves dislocation of both subtalar (talocalcaneal) and talonavicular joints, without involvement of tibiotalar and calcaneocuboid joints, and without any associated talar neck fracture [13]. It occurs following high energy trauma such as fall from a height or from motor vehicle accidents, it usually involves active young men [14,15].

Subtalar joint dislocation was first described by Juday and Dufaurest in 1811 [11]. In 1852, Broca classified subtalar dislocations into three types: medial, lateral and posterior, depending on the direction of dislocation [12]. In 1856 Malgaigne and Burguer reported the first case of anterior subtalar dislocation and adjusted the Broca's classification by adding the anterior dislocation type [5,7,11]. The medial dislocation known as “acquired clubfoot deformity” or “basketball foot” is the most common, and accounts for 80–85% of all cases, it occurs with the foot in an inverted plantar flexed position [2,6,14]. Lateral dislocation also known as “acquired flatfoot” represents 15–20% of dislocations and occurs with the foot in an everted plantar flexed position [2,6,14]. The posterior that occurs with excessive plantar flexion [2,14] and the anterior forms

are rare and account for 2.5% and <1% of dislocations, respectively [3,6,7,10].

The diagnosis of subtalar dislocation is based on the clinical appearance as described by Larsen, radiographic evaluation and possibly a CT-scan for evaluation of associated fractures [3,5,6].

For the Treatment of subtalar dislocations, emergency reduction seems to be essential owing to the risk of secondary cutaneous necrosis by ischemia [10]. To manually reduce the dislocation, the knee should be flexed to decrease the tension exerted by the Achilles tendon, longitudinal traction in the axis of the leg should then be performed on the foot, involving accentuation of the initial deformity, next, by dorsally flexing the ankle, the opposite maneuver to the deformation should be applied [1,10,11]. In 10% of medial subtalar dislocations and 15%–20% of lateral subtalar dislocations, open reduction is necessary because of soft tissue interposition and blocking of the fracture fragments [1]. If the subtalar joint is stable after reduction, no osteosynthesis is necessary; a cast immobilization for a period varying from 3 to 6 weeks is recommended [2,3,10]. In the case of instability after reduction, temporary fixation with talo-navicular Kirschner wires or, as described by Harris et al., external fixator can be used for temporary immobilization [2,5,7]. Even with adequate treatment several complications can follow this type of injuries, these include stiffness, arthritis, instability, avascular necrosis of the talus [5,7].

In our case, of subtalar dislocation with associated calcaneal fracture, we encountered a peroperative postreduction instability. As described earlier, when present, this rare entity was managed either by trans-articular K-wire fixation or by external fixation, but no consensus in the literature about which treatment method is the best and as described in the literature, these should be treated on an individual basis. We decided to reconstruct the deficient calcaneofibular ligament using a synthetic graft to act as a subtalar stabilizer and maintain the reduction. After this reconstruction the subtalar joint was stable postoperatively, and on postoperative follow ups, up to 2 years, the patient was doing well with no residual instability, pain or stiffness.

4. Conclusion

In conclusion, subtalar dislocation is a rare injury with post reduction instability being even rarer. The present case represents the first reported case where the reconstruction of the calcaneofibular ligament using a synthetic graft was used to stabilize an unstable subtalar dislocation with an excellent clinical and radiological 2 year follow up. Our case highlighted the importance of the calcaneofibular ligament as a subtalar stabilizer and stresses on the fact that this ligament should be studied more deeply to evaluate its stabilizing role on both the tibio-talar and the subtalar joints.

Patient perspective

The patient was satisfied with the result, and the patient returned to his regular activity 1 year post-operatively.

Declaration of Competing Interest

The authors report no declarations of interest.

Sources of funding

This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

Ethical approval

This type of study is exempt from ethical approval.

Consent

Written informed consent was obtained from the patient for publication of this case report and accompanying images. A copy of the written consent is available for review by the Editor-in-Chief of this journal on request.

Authors contribution

Writing the paper: Khalil T. Khalil, Mohammad Boushnak, Alain Akiki.

Data collection: Mohamad K MOUSSA, Salar P. Jafar.

Supervision: Khalil T. Khalil.

Registration of research studies

Not Applicable.

Guarantor

Dr. Khalil T. Khalil.

Provenance and peer review

Not commissioned, externally peer-reviewed.

References

- [1] C.H. Park, K.H. Park, Fracture of the posterior process of the talus with concomitant subtalar dislocation, *J. Foot Ankle Surg.* 55 (2016) 193–197, <http://dx.doi.org/10.1053/j.jfas.2015.05.006>.
- [2] A.Q. Teo, F. Han, Y.H. Chee, G.K. O'Neill, Unstable open posterior subtalar dislocation treated with a ring external fixator: a case report and review of the literature, *J. Foot Ankle Surg.* 56 (2017) 1279–1283, <http://dx.doi.org/10.1053/j.jfas.2017.04.032>.
- [3] J.T. Daniel, G. Burian, P.B. Joseph, Lateral subtalar dislocation: review of the literature and case presentation, *J. Foot Ankle Surg.* 37 (1988) 239–247, [http://dx.doi.org/10.1016/s1067-2516\(98\)80118-x](http://dx.doi.org/10.1016/s1067-2516(98)80118-x).
- [4] A. Michael, I.P. David, M.R. Steven, Subtalar instability, *Foot Ankle Clin.* 20 (June (2)) (2018) 243–252, <http://dx.doi.org/10.1016/j.fcl.2015.02.007>.
- [5] R. Stefan, G. Jens, S. Rammelt, J. Goronzy, Subtalar dislocations, *Foot Ankle Clin.* 20 (June (2)) (2015) 253–264.
- [6] B.R. David, J.F. Anthony, Lateral subtalar joint dislocation: a case with calcaneal fracture, *J. Am. Podiatr. Med. Assoc.* 94 (January (1)) (2004) 65–69, [10.7547/87507315-94-1-65](https://doi.org/10.7547/87507315-94-1-65).
- [7] P.C. Alfonso, A.M. Ismael, V.R. Jesúset, P.M. Juan, Subtalar dislocation: management and prognosis for an uncommon orthopaedic condition, *Int. Orthop.* (SICOT) 999 (2016) 1007, <http://dx.doi.org/10.1007/s00264-015-2910-8>.
- [8] S.I. Ringleb, A. Dhakal, C.D. Anderson, S. Bawab, R. Paranjape, Effects of lateral ligament sectioning on the stability of the ankle and subtalar joint, *J. Orthop. Res.* 29 (October (10)) (2011) 1459–1464, <http://dx.doi.org/10.1002/jor.21407>, Epub 2011 March 28. PMID: 21445995.
- [9] R.A. Agha, T. Franchi, C. Sohrabi, G. Mathew, for the SCARE Group, The SCARE 2020 guideline: updating consensus surgical CAse REport (SCARE) guidelines, *Int. J. Surg.* 84 (2020).
- [10] F. Ruhlmann, C. Poujardieu, J. Vernois, L.E. Gayet, Isolated acute traumatic subtalar dislocations: review of 13 cases at a mean follow-up of 6 years and literature review, *J. Foot Ankle Surg.* 56 (January (1)) (2017) 201–207, <http://dx.doi.org/10.1053/j.jfas.2016.01.044>.
- [11] S.H. Hui, T.H. Lui, Anterior subtalar dislocation with comminuted fracture of the anterior calcaneal process, *BMJ Case Rep.* (February) (2016), <http://dx.doi.org/10.1136/bcr-2015-213835>, bcr2015213835. PMID: 26887882; PMCID: PMC5483542.
- [12] S.V. Ewout, J.A. Sernst, W. Philippe, K. Jort, Lateral subtalar dislocation: case report and review of the literature, *World J. Orthop.* (2016) 623–627, <http://dx.doi.org/10.5312/wjo.v7.i9.623>.

- [13] G. Sahil, K. Arvind, T. Vivek, D. Saubhik, A. Prabhat, Posterior dislocation of subtalar joint without associated fracture: a case report and review of literature, *J. Clin. Diagn. Res.* 11 (2017), <http://dx.doi.org/10.7860/JCDR/2017/27794.10553>.
- [14] G. Dionisios, P. Dimitrios, G.L. Marios, K. Panagiotis, G. Ioannis, M. Alexandros, Subtalar dislocation without associated fractures: case report and review of literature, *World J. Orthop.* 6 (April (3)) (2015) 374, <http://dx.doi.org/10.5312/wjo.v6.i3.374>.
- [15] K. Nicola, H.L. Tamara, H. Beat, K. Markus, The subtalar joint: a complex mechanism, *EFORT Open Rev.* 2 (July (7)) (2017) 309–316, <http://dx.doi.org/10.1302/2058-5241.2.160050>.

Open Access

This article is published Open Access at [sciencedirect.com](https://www.sciencedirect.com). It is distributed under the [IJSCR Supplemental terms and conditions](#), which permits unrestricted non commercial use, distribution, and reproduction in any medium, provided the original authors and source are credited.