Traumatic subtalar joint dislocation

Abstract

Although uncommon, subtalar joint dislocations remain a frequently missed orthopaedic emergency. Detailed soft tissue and neurovascular assessment is important and these should be documented as appropriate. Failure of urgent reduction might lead to increased risk of conversion to an open injury as a result of pressure necrosis of the overlying skin, risk of talar avascular necrosis and risk of neurovascular compromise. A computed tomography scan is needed in all cases following successful closed or open reduction to identify associated occult foot and ankle fractures. The goal of treatment is to reduce the risk of soft tissue and neurovascular compromise and achieve a supple, painless foot.

This article highlights the importance of early identification of this injury and institution of appropriate management according to the latest evidence, to reduce the risk of complications and lead to the best outcomes.

Key words: Hindfoot trauma; Peritalar dislocation; Subtalar dislocation; Subtalar joint; Talocalcaneonavicular dislocation

Submitted: 24 April 2022; accepted following double-blind peer review: 1 November 2022

Fitzgerald C Anazor[1,2]

Baljinder S Dhinsa[1]

Author details can be found at the end of this article

Correspondence to:
Fitzgerald C Anazor
anazorfitzgerald@yahoo.com

Introduction

A subtalar joint dislocation occurs when there is complete displacement with loss of congruency of the talocalcaneal and talonavicular articulations (Jungbluth et al, 2010). A good understanding of the subtypes in relation to the level of energy involved and correlation with the clinical presentation, a sound understanding of the methods for emergent closed reduction and high index of suspicion for associated occult fractures is important for the orthopaedic or emergency department medical practitioner.

Although relatively uncommon, these injuries are orthopaedic emergencies because of the propensity for associated avascular necrosis of the talus, soft tissue compromise, cartilage injuries and possible neurovascular compromise if left unreduced or when there is delay in achieving successful reduction.

This article highlights the importance of early identification of this injury and institution of appropriate management to reduce the risk of complications and lead to the best outcomes.

Epidemiology

Subtalar joint dislocations, also known as peritalar dislocations, are relatively uncommon orthopaedic injuries, accounting for about 1–2% of all dislocations and 1% of all traumatic foot injuries (DeLee and Curtis, 1982; Hoexum and Heetveld, 2014; Prada-Cañizares et al, 2016). Subtalar dislocations account for 15% of all peritalar injuries (Rammelt and Goronzy, 2015).

Multiple injury mechanisms account for subtalar joint dislocations with road traffic accidents accounting for 43.7%, falls 32.9%, sports injuries 19.2% and other causes 4.2% (Hoexum and Heetveld, 2014). The male:female ratio is 3:1 and the mean age of occurrence is 33.8 years. Hoexum and Heetveld (2014) found that 61% of cases occur on the right foot.

Classification

There are four main types of subtalar joint dislocation: medial, lateral, anterior and posterior, based on the position of the foot relative to the talus. The medial subtype usually occurs from low energy trauma and is the most common, accounting for 80–85% of cases whereas the lateral subtype accounts for 15–20% of cases. Posterior (2.5% of cases) and anterior (<1% of cases) subtalar joint dislocations are rare (Hoda, 2009).

How to cite this article:
Anazor FC, Dhinsa BS. Traumatic subtalar joint dislocation. Br J Hosp Med. 2023. https://doi.org/10.12968/hmed.2022.0211

Anatomy

There are two parts to the subtalar joint complex: the talocalcaneal joint, which is formed posteriorly by the posterior talar facet sitting congruently on the posterior calcaneal facet and the talocalcaneonavicular articulation anteriorly (Sharma et al, 2021). The shape of the convex talar head articulating with the concave navicular also adds to the stability of this arrangement.

Apart from the bony architecture, ligaments play a major role in the stability of the subtalar joint. The calcaneofibular ligament is the main stabiliser of the subtalar joint in inversion, while the talocalcaneal ligaments play the same role in eversion. The joint capsule, in combination with other medial and lateral ligaments, plays a lesser but still important role in subtalar joint stability.

The blood supply of the talus was classically believed to be retrograde, but a good antegrade supply also exists (Al-Jabri et al, 2021). The main blood supply is from the posterior tibial artery, via the artery of the tarsal canal, and deltoid branches supplying the body and posterior process. The anterior tibial artery, via the dorsalis pedis artery, supplies the anterior aspect of the head and neck. The peroneal artery, via the artery of the tarsal sinus, supplies the head and neck and communicates with the artery of the tarsal canal. In subtalar dislocations associated with a talar neck fracture, the deltoid branches may be the only remaining supply, and medial dissection and soft tissue stripping should be avoided to reduce the risk of avascular necrosis (Prasarn et al, 2010).

Pathomechanics

Medial subtalar dislocations occur as a result of low energy injury mechanisms where there is forced plantarflexion and inversion of the foot. This causes the talar neck to hinge and rotate around the sustentaculum tali, resulting in disruption of the lateral talonavicular ligaments and joint capsule.

The lateral subtype results from high energy injury mechanisms, such as following road traffic accidents or falls from heights. There is forceful dorsiflexion and eversion of the foot leading to pivoting of the talar head on the anterior process of the calcaneum and subsequent rupture of the talonavicular ligaments, with possible associated extension to and rupture of the deltoid ligament (Sharma et al, 2021).

Diagnosis

All patients presenting to the emergency department with high energy injury mechanisms should be assessed using advanced trauma life support principles (American College of Surgeons Committee On Trauma, 2018). A thorough assessment of the neurovascular status of the foot is important and this should be clearly documented. Feet should be checked for open wounds, fracture blisters, skin tenting and ecchymosis as these are indicators of soft tissue compromise and increased risk of infection.

A subtalar joint dislocation is usually suspected on clinical examination based on the position of the foot. In a medial subtalar joint dislocation, there is usually a ‘clubfoot’ appearance with the hindfoot in varus, and the forefoot adducted and supinated, and the talar head may be palpable laterally.

In a lateral subtalar joint dislocation, the heel is in valgus, the forefoot is abducted and there is a ‘flat foot’ deformity, with the talar head palpable medially in some cases. Because these injuries are more likely to be associated with other foot and ankle injuries, a thorough examination should be undertaken.

In the anterior and posterior subtypes, there may be no gross deformity and the diagnosis is made on plain X-rays or computed tomography scans.

In a patient with an obvious subtalar joint dislocation, an urgent closed reduction should be performed before obtaining plain anteroposterior and lateral ankle X-rays (**Figures 1** and **2**). An associated occult bony injury is seen in up to 76% of cases (Jungbluth et al, 2010), so a computed tomography scan with three-dimensional reconstruction (**Figures 3a** and **b**) is required in all cases to diagnose associated occult bony injuries and assess adequacy of the reduction (Melenevsky et al, 2015; Veltman et al, 2016). Magnetic

resonance imaging is not usually needed in the acute setting but may be obtained in the later stages of management if there is suspicion of an osteochondral lesion, tendon or ligament injury.

Figure 1. Plain anteroposterior X-ray of the left ankle showing medial subtalar dislocation. Note the talus is impinging on the skin around the lateral ankle/hind foot area.

Figure 2. Plain anteroposterior X-ray of the left ankle showing lateral subtalar dislocation with a distal fibula fracture and tibiotalar joint subluxation. Note that the talar head is impinging on the skin around the medial aspect of the ankle.

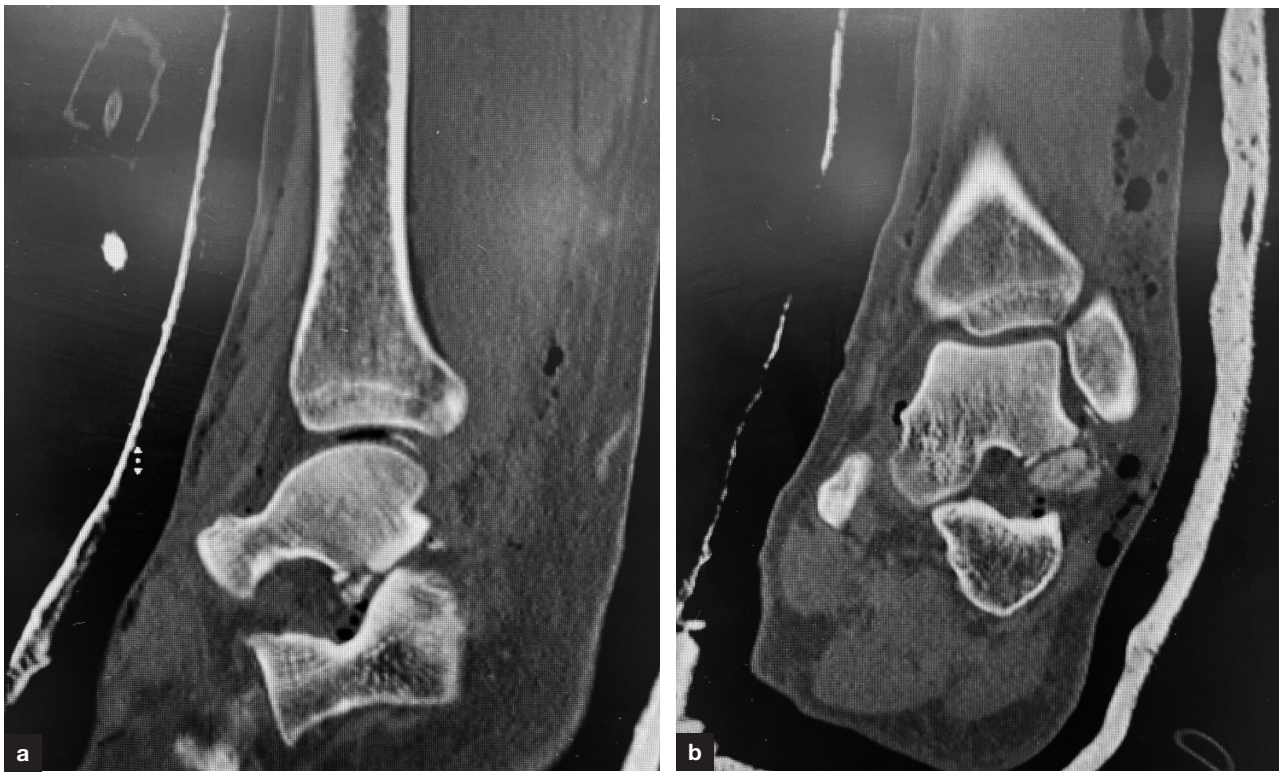

Figure 3. a. Sagittal reformatted computed tomography scans of the ankle and hindfoot showing a lateral process fracture of the talus. These injuries can easily be missed on plain X-rays. Also note the subcutaneous emphysema posteriorly. This patient presented with an open lateral subtalar dislocation (same patient in **Figure 6**). b. Coronal reformatted computed tomography scan demonstrating the lateral process talus fracture and subcutaneous emphysema.

Treatment

The short- to mid-term goals of treatment are to reduce further soft tissue compromise, reduce the incidence of neurovascular injury, reduce the risk of further chondral injury and identify and treat any associated peritalar injuries. The long-term goal is to achieve a supple foot and ankle that permit painless weight-bearing. **Figure 4** shows the authors' treatment algorithm.

The first step in treatment is urgent closed reduction under sedation or other appropriate regional anaesthetic policies, ensuring patient safety.

For medial subtalar dislocations, an assistant flexes the knee to 90° to neutralise the pull of the gastrocnemius muscle. The clinician performing the reduction holds the heel and exaggerates the deformity via plantarflexion and inversion of the foot to unlock the calcaneum from the talus. Traction is then applied longitudinally via the heel with the assistant that is holding the leg applying gentle counter-traction. The foot is gently everted and dorsiflexed and pressure applied on the talar head, which is palpable laterally. A clunk is heard or felt as the subtalar joint is reduced. A below-knee plaster back slab is then applied to maintain the reduction and check X-rays obtained.

For a lateral subtalar dislocation, the knee is flexed following the same principles above, the deformity is exaggerated via dorsiflexion and eversion of the foot to unlock the calcaneum from underneath the talus and traction-countertraction is applied followed by plantarflexion and inversion of the foot, with pressure applied medially to the talar head to complete the reduction.

For anterior and posterior subtalar joint dislocation, the principles are the same. The difference is that the heel is pushed posteriorly following traction-countertraction for the anterior subtalar joint dislocation, while it is manipulated anteriorly for the posterior subtype.

Following reduction in all cases, there should be a marked improvement of the initial deformity. Neurovascular status should be reassessed and documented in the patient's notes, a below-knee plaster slab applied and check X-rays obtained to confirm the reduction. All patients should have the limb elevated to reduce swelling and promote soft tissue healing.

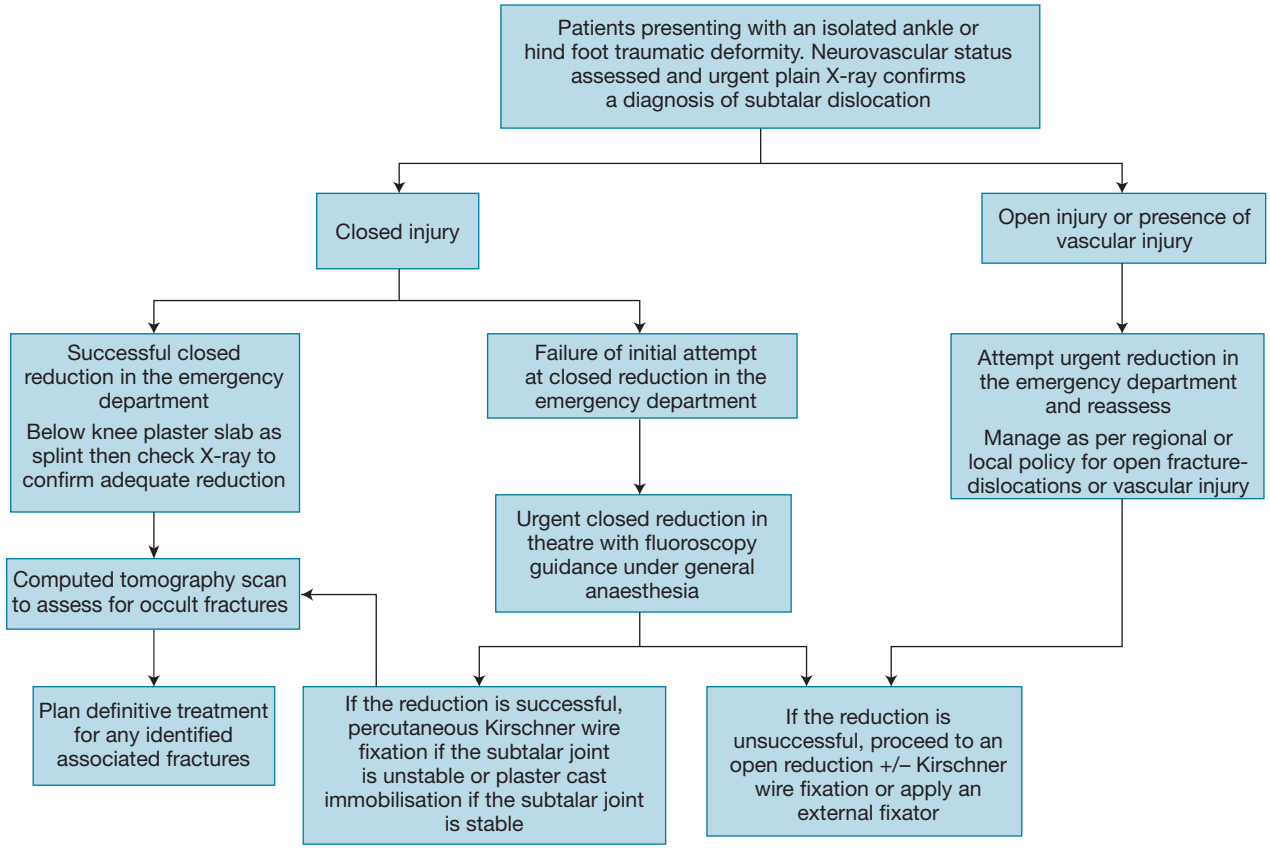

Figure 4. Initial management of a patient with a subtalar joint dislocation.

As mentioned earlier, a computed tomography scan is required in all cases following successful reduction, preferably before transferring the patient to the ward or ideally within 24 hours.

Closed reduction is usually successful in about 65% of cases (Jungbluth et al, 2010). Failure of closed reduction in the emergency department could be the result of use of an inappropriate technique by the clinical practitioner via dorsiflexion, such as an ankle joint dislocation reduction technique. Failure of closed reduction could also be a result of buttonholing of the talar head through the joint capsule, incarceration of anterior or lateral structures like the extensor retinaculum, peroneal tendons and extensor tendons for medial subtalar joint dislocations (Heck et al, 1996). For lateral subtalar joint dislocations, difficult or irreducible subtalar joint dislocation is usually a result of trapped medial structures such as the tibialis posterior tendon, flexor hallucis longus tendon, flexor digitorum longus tendon or osteochondral fragments (Waldrop et al, 1992). Failure of closed reduction in the emergency department can occur in 10–32% of cases (De Palma et al, 2008) and warrants taking the patient to theatre and re-attempting closed reduction under general anaesthesia to ensure adequate muscle relaxation. If reduction is still unsuccessful, an open reduction should be performed in theatre because it is likely that interposition of soft tissue is preventing successful reduction.

If the subtalar joint still feels unstable following closed or open reduction in theatre, multiple K-wires should be passed to secure the talonavicular and talocalcaneal joints (Figure 5). Multiple attempts at closed reduction in the emergency department should be avoided to reduce the risk of iatrogenic chondral or neurovascular injury (Tzimas et al, 2020).

For open subtalar joint dislocations (Figure 6), which account for 22–25% of all cases (Bibbo et al, 2003; Teo et al, 2017), treatment should be as per the British Orthopaedic Association (2017) standards for trauma (BOAST) open fracture treatment guidelines. If reduction is successful, urgent surgical debridement should be performed if there

Figure 5. Intraoperative fluoroscopy image for the patient in **Figure 2** following closed reduction and percutaneous Kirschner wire fixation to provide stability for the talocalcaneal and talonavicular joints.

Figure 6. Clinical photograph of the patient in **Figure 3** on presentation to the emergency department showing an open left lateral subtalar dislocation.

is significant contamination or when there is evidence of neurovascular compromise. Following debridement in theatre, a joint spanning external fixator may be applied if the subtalar joint is unstable, especially if there is significant soft tissue compromise. An alternative is fixation with Kirschner wires (Merchan, 1992). A plaster slab is an option if the reduction is stable. The Kirschner wires and/or plaster cast are removed at around 4 weeks postoperatively.

Full weight-bearing can be started immediately after surgery except in cases of marked instability where non-weight-bearing is preferred until 6 weeks postoperatively, before switching to partial and then full weight-bearing (Sharma et al, 2021). However, some authors recommend non-weight bearing for a minimum of 4 weeks initially following casting or fixation, irrespective of joint stability (Perugia et al, 2002; Teo et al, 2017).

All patients are usually started on a rehabilitation protocol with range of motion exercises by the physiotherapist around 3–4 weeks for stable injuries and 6 weeks or more for unstable injuries or those with associated intra-articular fractures (Garofalo et al, 2004; Hoexum and Heetveld, 2014; Veltman et al, 2016). An early mobilisation protocol reduces the risk of subtalar joint or ankle joint stiffness (Lasanianos et al, 2011).

Appropriate venous thromboembolism prophylaxis should be prescribed for all patients throughout the period of limited weight-bearing or reduced mobilisation up to a maximum of 42 days postoperatively (National Institute for Health and Care Excellence, 2019).

Outcomes

In isolated, closed subtalar joint dislocations that are reduced optimally in good time and with immobilisation not exceeding 4 weeks, the outcomes are usually good (Camarda et al, 2016; Sharma et al, 2021). This explains why early identification and urgent reduction is emphasised.

Poor prognostic factors for subtalar joint dislocations include open injuries, associated fractures and delays in achieving successful reduction (Merchan, 1992). Lateral subtalar joint dislocation has a worse prognosis than the medial subtype because the higher energy trauma involved causes a higher incidence of open injuries and associated fractures (DeLee and Curtis, 1982).

Early complications specific to subtalar joint dislocations include soft tissue ischaemia and skin breakdown from tenting, compartment syndrome of the foot, neurovascular compromise and infection in open injuries.

Specific long-term complications include subtalar joint stiffness with reduced eversion and inversion of the foot and ankle joint stiffness from prolonged immobilisation. Post-traumatic subtalar joint osteoarthritis is the most common complication occurring in 16–89% of cases (Bibbo et al, 2003; Veltman et al, 2016) and may require subtalar joint fusion in the long term if significantly symptomatic. Other long-term complications include avascular necrosis of the talus with risk ranging from 0% in closed isolated subtalar joint dislocation (Ruhlmann et al, 2017) to as high as 50% in open dislocations (Sharma et al, 2021). The patient should also be counselled on the risk of complex regional pain syndrome and persisting instability.

In cases of persisting instability, medial or lateral ligament reconstruction may be considered following appropriate clinical assessment, stress X-rays, computed tomography scan and magnetic resonance imaging scan as indicated. In severe persisting subtalar joint instability with associated subtalar joint arthritis, a subtalar joint arthrodesis is a viable treatment option if alignment is maintained (Pereira et al, 2021).

Conclusions

This article highlights the importance of early diagnosis and urgent reduction of subtalar joint dislocations in the emergency department or theatre, including the importance of early identification and treatment of associated fractures. The basic principles for performing a closed reduction are described and will hopefully be useful to the emergency room clinician and the orthopaedic trainee. It is important to have a high index of suspicion and to scrutinise ankle X-rays accurately in the patient presenting with a suspected ‘ankle dislocation’ to avoid missing a subtalar joint dislocation. It is also worth remembering that these injuries may be associated with talar, calcaneal or other foot or ankle fractures and a computed tomography scan is required in all cases to identify these.

The orthopaedic team should be involved in the acute management of all cases of subtalar joint dislocation. This is not an injury to be sent straight to the virtual or face-to-face fracture clinic from the emergency department.

Key points

- Subtalar joint dislocations, although uncommon, remain an easily missed orthopaedic emergency.
- There are four main types of subtalar joint dislocation, with medial dislocation being the most common.
- Detailed soft tissue and neurovascular assessment is important and these should be imaged and documented as appropriate.
- Failure of urgent reduction might lead to increased risk of conversion to an open fracture from ischaemic pressure necrosis of the skin, risk of talar avascular necrosis and neurovascular compromise.
- A computed tomography scan is needed in all cases following successful closed or open reduction to identify associated occult foot and ankle fractures.
- Failure of closed reduction in the emergency department warrants urgent attempted closed reduction in theatre under anaesthesia and conversion to an open reduction if indicated.
- All open subtalar joint dislocations should be managed as per the BOAST guidelines or other available national and local guidelines.

Author details

[1]Department of Trauma and Orthopaedics, William Harvey Hospital, Ashford, UK

[2]Postgraduate Medical Education Directorate, Nottingham University NHS Foundation Trust, UK

Conflicts of interest

The authors declare that there are no conflicts of interest.

References

Al-Jabri T, Muthian S, Wong K, Charalambides C. Talus fractures: all I need to know. Injury. 2021;52(11):3192–3199. https://doi.org/10.1016/j.injury.2021.10.008

American College of Surgeons Committee on Trauma. Advanced trauma life support: student course manual. 10th edn. Chicago: American College of Surgeons; 2018

Bibbo C, Anderson R, Davis W. Injury characteristics and the clinical outcome of subtalar dislocations: a clinical and radiographic analysis of 25 cases. Foot Ankle Int. 2003;24(2):158–163. https://doi.org/10.1177/107110070302400210

British Orthopaedic Association. Open fractures. 2017. https://www.boa.ac.uk/static/3b91ad0a-9081-4253-92f7d90e8df0fb2c/29bf80f1-1cb6-46b7-afc761119341447f/open%20fractures.pdf (accessed 2 February 2023)

Camarda L, Abruzzese A, La Gattuta A, Lentini R, D'Arienzo M. Results of closed subtalar dislocations. Musculoskelet Surg. 2016;100(1):63–69. https://doi.org/10.1007/s12306-015-0380-1

DeLee J, Curtis R. Subtalar dislocation of the foot. J Bone Joint Surg Am. 1982;64(3):433–437

De Palma L, Santucci A, Marinelli M, Borgogno E, Catalani A. Clinical outcome of closed isolated subtalar dislocations. Arch Orthop Trauma Surg. 2008;128(6):593–598. https://doi.org/10.1007/s00402-007-0459-8

Garofalo R, Moretti B, Ortolano V et al. Peritalar dislocations: a retrospective study of 18 cases. J Foot Ankle Surg. 2004;43(3):166–172. https://doi.org/10.1053/j.jfas.2004.03.008

Heck B, Ebraheim N, Jackson W. Anatomical considerations of irreducible medial subtalar dislocation. Foot Ankle Int. 1996;17(2):103–106. https://doi.org/10.1177/107110079601700208

Hoda S. Subtalar dislocation. Orthopedics. 2009;32(12). https://doi.org/10.3928/01477447-20091020-17

Hoexum F, Heetveld M. Subtalar dislocation: two cases requiring surgery and a literature review of the last 25 years. Arch Orthop Trauma Surg. 2014;134(9):1237–1249. https://doi.org/10.1007/s00402-014-2040-6

Jungbluth P, Wild M, Hakimi M et al. Isolated subtalar dislocation. J Bone Joint Surg Am. 2010;92(4):890–894 https://doi.org/10.2106/JBJS.I.00490

Lasanianos N, Lyras D, Mouzopoulos G, Tsutseos N, Garnavos C. Early mobilization after uncomplicated medial subtalar dislocation provides successful functional results. J Orthopaed Traumatol. 2011;12(1):37–43. https://doi.org/10.1007/s10195-011-0126-2

Melenevsky Y, Mackey R, Abrahams RA, Thomson N. Talar fractures and dislocations: a radiologist's guide to timely diagnosis and classification. Radiographics. 2015;35(3):765–779. https://doi.org/10.1148/rg.2015140156

Merchan E. Subtalar dislocations: long-term follow-up of 39 cases. Injury. 1992;23(2):97–100. https://doi.org/10.1016/0020-1383(92)90041-P

National Institute for Health and Care Excellence. Venous thromboembolism in over 16s: reducing the risk of hospital-acquired deep vein thrombosis or pulmonary embolism. 2019. https://www.nice.org.uk/guidance/ng89/chapter/Recommendations#interventions-for-people-having-orthopaedic-surgery (accessed 5 December 2022)

Pereira BS, Andrade R, Espregueira-Mendes J et al. Current concepts on subtalar instability. Orthop J Sports Med. 2021;9(8):232596712110213. https://doi.org/10.1177/23259671211021352

Perugia D, Basile A, Massoni C et al. Conservative treatment of subtalar dislocations. Int Orthop. 2002;26(1):56–60. https://doi.org/10.1007/s002640100296

Prada-Cañizares A, Auñón-Martín I, Vilá y Rico J, Pretell-Mazzini J. Subtalar dislocation: management and prognosis for an uncommon orthopaedic condition. Int Orthop. 2016;40(5):999–1007. https://doi.org/10.1007/s00264-015-2910-8

Prasarn M, Miller A, Dyke J, Helfet D, Lorich D. Arterial anatomy of the talus: a cadaver and gadolinium-enhanced MRI study. Foot Ankle Int. 2010;31(11):987–993. https://doi.org/10.3113/FAI.2010.0987

Rammelt S, Goronzy J. Subtalar dislocations. Foot Ankle Clin. 2015;20(2):253–264. https://doi.org/10.1016/j.fcl.2015.02.008

Ruhlmann F, Poujardieu C, Vernois J, Gayet L. Isolated acute traumatic subtalar dislocations: review of 13 cases at a mean follow-up of 6 years and literature review. J Foot Ankle Surg. 2017;56(1):201–207. https://doi.org/10.1053/j.jfas.2016.01.044

Sharma S, Patel S, Dhillon M. Subtalar dislocations. Jaaos Glob Res Rev. 2021;5(12). https://doi.org/10.5435/JAAOSGlobal-D-21-00295

Teo A, Han F, Chee Y, O'Neill G. Unstable open posterior subtalar dislocation treated with a ring external fixator: a case report and review of the literature. J Foot Ankle Surg. 2017;56(6):1279–1283. https://doi.org/10.1053/j.jfas.2017.04.032

Tzimas V, Panagiotopoulos V, Konidaris K, Georgoulas P. Closed isolated subtalar dislocation: a rare clinical entity with a combined rehabilitation approach. Trauma Case Rep. 2020;30:100361. https://doi.org/10.1016/j.tcr.2020.100361

Veltman E, Steller E, Wittich P, Keizer J. Lateral subtalar dislocation: case report and review of the literature. World J Orthop. 2016;7(9):623. https://doi.org/10.5312/wjo.v7.i9.623

Waldrop J, Ebraheim N, Shapiro P, Jackson W. Anatomical considerations of posterior tibialis tendon entrapment in irreducible lateral subtalar dislocation. Foot Ankle. 1992;13(8):458–461. https://doi.org/10.1177/107110079201300805