



The Floating Fibula: Outcome of Pure Tibiotalar Dislocation with Lesion to the Proximal Tibiofibular Joint: Case Report

El peroné flotante: Resultado de una luxación tibioastragalina pura con lesión de la articulación tibioperonea proximal: Reporte de caso

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Abstract

Background Floating fibula after high-energy trauma is a very uncommon entity. The present is the first report of a case associated with avulsion of the bicipital tendon.

Purpose To present a case of floating fibula after divergent ankle dislocation associated with proximal peroneal dislocation.

Materials and methods A 17-year-old woman who fell after a traffic accident and presented pain and deformity of the left ankle with pain and functional impotence in the ipsilateral knee. The radiographs showed a pure divergent type-IV left-ankle dislocation. Closed reduction was performed in the emergency room. The study was complemented with a magnetic resonance imaging scan which showed complete rupture of the syndesmosis and the deltoid ligament, as well as a non-displaced fracture of the external tibial plateau together with a tear of the proximal tibiofibular capsule and complete detachment of the external lateral ligament and bicipital tendon from its insertion in the peroneal head.

The syndesmosis and deltoid ligament were reanchored, as well as the external lateral ligament and the bicipital tendon, using metallic bone anchors and fibula reduction both proximally and distally, using a suture-button system. The patient was immobilized with a long-leg splint for four weeks.

Results The patient presented complete recovery of strength at five months of follow-up.

Conclusion Floating fibula is a rare entity, with only one case described in the literature. It involves a disruption of the proximal and distal tibiofibular joint, which can lead to knee and ankle instability.

Keywords

- ▶ fibula
- ▶ syndesmosis
- ▶ floating

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Therefore, in cases of high-energy trauma to the ankle, a careful examination of the ipsilateral knee is necessary.

Resumen

Antecedentes El peroné flotante tras un traumatismo de alta energía es una entidad muy poco frecuente. Este es el primer reporte de caso asociado a luxación del tendón bicipital.

Objetivo Presentar un caso de peroné flotante tras luxación divergente de tobillo asociado a luxación peronea proximal.

Materiales y métodos Mujer de 17 años que, tras accidente de tráfico, sufrió caída y presentó dolor y deformidad del tobillo izquierdo, junto con dolor e impotencia funcional de la rodilla ipsilateral. En las radiografías, se apreció una luxación pura divergente del tobillo izquierdo de tipo IV. Se realizó reducción cerrada en urgencias. El estudio se complementó con una resonancia magnética que mostró una rotura completa de la sindesmosis y del ligamento deltoideo, así como una fractura no desplazada de la meseta tibial externa, junto con un desgarro de la cápsula tibioperonea proximal y desprendimiento completo del ligamento lateral externo y del tendón bicipital desde su inserción en la cabeza del peroné.

Se realizó reanclaje de la sindesmosis y del ligamento deltoideo, así como del ligamento lateral externo y del tendón bicipital mediante anclajes óseos metálicos y reducción de peroné tanto proximal como distalmente, mediante sistema de sutura tipo botón. Se inmovilizó con férula cruropédica por cuatro semanas.

Resultados La paciente presentó recuperación completa de la fuerza a los cinco meses de seguimiento, con movilidad completa del tobillo y de la rodilla.

Conclusión El peroné flotante es muy poco frecuente; sólo se ha descrito un caso en la literatura. Implica la disrupción de la articulación tibioperonea proximal y distal, lo que puede provocar inestabilidad en la rodilla y en el tobillo.

Por tanto, ante un traumatismo de alta energía en el tobillo, es necesaria la exploración minuciosa de la rodilla ipsilateral.

Palabras clave

- ▶ fíbula
- ▶ sindesmosis
- ▶ flotante

Introduction

Isolated tibiotalar dislocations are very uncommon injuries. Due to the intrinsic stability of the ankle joint and the mechanism of injury, these lesions are most often combined with bone fractures.¹⁻³ The stability of the tibiofibular joint, both proximal and distal, are provided by the strength of the capsule and its ligamentous complex. The simultaneous disruption of both the proximal and distal syndesmosis is known as floating fibula.^{3,4} There is only one case of this injury described in the literature, and we herein present the first case associated with biceps avulsion (not only passive stabilizers of the knee joint, but also active ones). We report a case of simultaneous proximal and distal tibiofibular joint disruption resulting in a floating fibula, which was stabilized with an implant of ankle syndesmosis repair system (INVISIKNOT, Smith & Nephew, Watford, Hertfordshire, United Kingdom) and some metallic bone anchor (TWINFIX, Smith & Nephew) implants.

Case Report

A 19-year-old woman injured her left leg in a traffic accident. Upon admission, the clinical examination revealed consider-

able swelling, pain on palpation, and total inability to move the ankle. She also suffered intense pain in her ipsilateral knee, with bruises in both the external and internal sides of the knee. Similar injuries appeared in both sides of the ipsilateral ankle as well (▶ Fig. 1A and B). No neurovascular injuries were observed. The radiographs showed an isolated tibiotalar dislocation with a significant diastasis of the syndesmosis associated to an ascending talus without any malleolar fracture. Because of the injury mechanism, we suspected an additional injury to the proximal tibiofibular joint, although there was no evidence of it on the radiograph. (▶ Fig. 1C, D and E).

Immediate closed reduction of the dislocation was performed under local anesthesia at the emergency room. The pulses of the distal ankle and dorsal pedis were intact after the reduction maneuver, with no clinical evidence of compartment syndrome in progress. A posterior splint was applied to temporarily immobilize the knee and ankle joints. Postreduction radiographs showed that a slight widening of the tibiotalar joint remained, especially in the medial clear space, but no changes were observed in the tibiofibular overlap (▶ Fig. 1F and G).

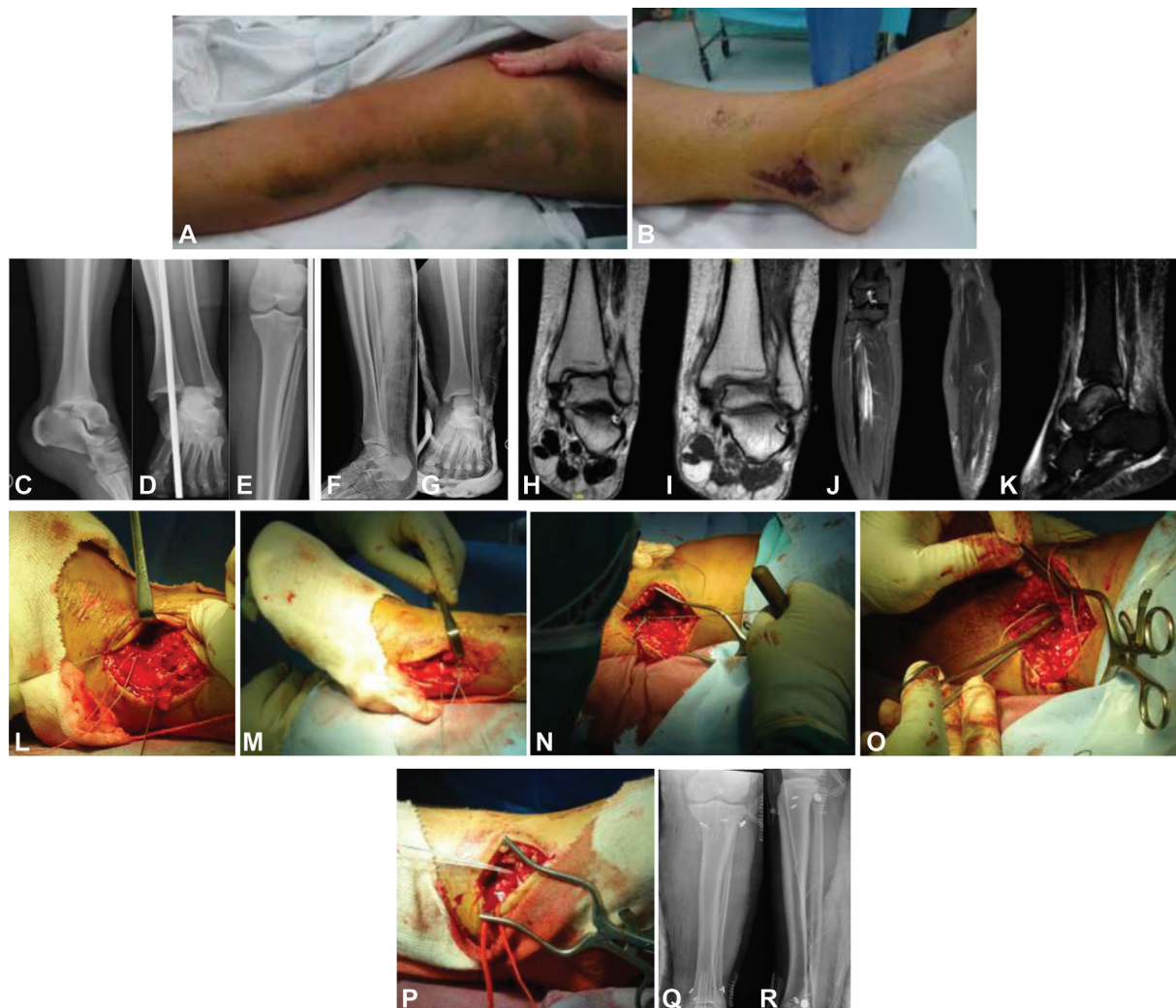


Fig. 1 (A,B) Contusions on the external and internal sides of the knee. Similar injuries appeared on both sides of the ipsilateral ankle as well. (C-E) Pure tibiotalar dislocation without fracture. (F,G) Postreduction radiograph showing persistence of the widening of the tibiotalar joint (medial clear space). (H-K) Magnetic resonance imaging scan showing complete rupture of the ankle syndesmosis and the deltoid ligament, and, proximally, an external non-displaced tibial plateau fracture and an image suggestive of non-displaced fibular head fracture. (L) Repair of the distal syndesmosis with a TWINFIX implant. (M,N) Reduction of the distal and proximal syndesmosis with INVISIKNOT implants. (O) Repair of the collateral ligament and biceps tendon with a TWINFIX implant. (P) Repair of the deltoid ligament with another TWINFIX implant. (Q,R) Postoperative radiographs showing the reduction and maintenance through INVISIKNOT and TWINFIX implants.

Due to the mechanism of injury and the extensive knee and ankle swelling, an emergency magnetic resonance imaging (MRI) scan of the ankle and the knee was performed, which showed complete rupture of the ankle syndesmosis, complete rupture of the deltoid ligament, a non-displaced external tibial plateau fracture, and an image suggestive of non-displaced fibular head fracture (►Fig. 1H, I, J and K).

One day after the injury, we proposed the surgery to the patient, who agreed to undergo it. We decided to repair the ligament injuries to reestablish/restore the stability of the ankle and explore the concomitant injury to the proximal tibiofibular joint.

Before the performance of the surgery, we observed a severe valgus instability of the knee that suggested a possible rupture of its collateral ligament or a complex posterolateral instability of the joint that results in a proximal fibular dislocation, which were all of the injuries the patient presented as a consequence

of a high-energy trauma: a pure tibiotalar dislocation with a proximal fibular luxation as a result of a complex injury of the posterolateral complex of the knee.

Under general anesthesia, without tourniquet, we first reduced the fibula proximally and distally, observing the absence of fractures, and repaired the distal syndesmosis with a TWINFIX implant (►Fig. 1L). After that, we maintained the reduction of the distal syndesmosis, and then, the proximal syndesmosis, with INVISIKNOT implants (►Figs. 1M and N). We also reinserted the lateral collateral ligament and the bicipital tendon posteriorly to the fibular head, which was completely torn, with another TWINFIX implant (►Figs. 1O). Finally, we reinserted the deltoid ligament with another TWINFIX implant (►Fig. 1P). The patient then wore an immobilizing plaster cast for four weeks to enable the healing of the ligaments, including the medial collateral ligament of the knee (►Fig. 1Q and R).

After four weeks, we removed the plaster cast and sent the patient to rehabilitation. After two months of rehabilitation, she was asymptomatic, and showed complete muscular strength with a slight limitation in terms of dorsiflexion of the talus.

Discussion

Floating fibula is described as a simultaneous disruption of both the proximal and distal tibiofibular syndesmosis.⁴ The first case was described by Pelc et al.,² and no other cases have been described in the literature. Pure tibiotalar dislocation associated with a proximal tibiofibular injury is an uncommon entity, because the ligaments are usually stronger than bone structures.^{3,5,6} Such ligament structures, both proximal and distal, are considered static stabilizers of the joints, enabling an external rotation of $\sim 5^\circ$ to 6° of the fibula with respect to the tibia during walking, and a widening of the distal tibiofibular joint of $\sim 1, 5$ mm during dorsiflexion of the foot to prevent ankle instability.^{7,8} We herein present a case of divergent dislocation without bone fracture, so it is important to distinguish it from the cases of dislocations due to transsyndesmotic ankle fracture, which are also called “log-splitter” injuries, a rare condition produced by vertical loads or by combined rotational force.⁶

Lamraski and Clegg¹ presented a patient with a divergent dislocation of the ankle without an associated lesion in the proximal tibiofibular joint, and they treated the lesion in the syndesmosis with a transsyndesmotic screw; similarly, Alami et al.³ presented another case of lesion in the distal tibiofibular joint without proximal injury, and they treated the disruption of the syndesmosis by means of two transsyndesmotic screws. In their case, the patient presented a luxation different from that of the case herein presented, because the fibula had rotated externally, posteriorly displacing the talus attached to the fibula. In our case, the fibula did not rotate externally, so the talus was not displaced posteriorly, but anteriorly.

Edwards and DeLee⁹ planned a classification of divergent ankle dislocations, but not considering a possible association with damage to the proximal tibiofibular joint: type I consists of an isolated lateral subluxation of the distal fibula without lateral deformity; type II is isolated lateral subluxation of the distal fibula with deformity; type III is rotational posterior subluxation of the distal fibula; and type IV, superior dislocation of the talus, grazing the fibula and the distal tibia. We propose a subclassification of this type taking into account a possible affectation of the proximal tibiofibular joint, which would be subdivided into type IVa if there is no involvement of the tibiofibular joint, and type IVb, which is the case herein presented, which affects the proximal tibiofibular joint.

Tears to the interosseous membrane lead to the potential risk of developing acute compartment syndrome because of the injury to the tibialis posterior artery or to some of its branches. As we observed, there was no clinical evidence of compartment syndrome in progress in our case, but cases of compartment syndrome after syndesmotic or ankle injuries have been described in the literature, such as those by Imade et al.¹⁰ and Mathews and Mutty.¹¹

As aforementioned, to date, only Pelc et al.² have described this association of lesions both at the proximal and distal levels acquiring a combined pathophysiology that can lead to instability of the ankle and knee if it is not properly diagnosed and treated. In addition to the distal and proximal tibiofibular syndesmosis, we need to mention the importance of the external collateral ligament and the femoral biceps tendon as stabilizers in varus of the knee joint, but, at the same time, stabilizers of the proximal tibiofibular joint.¹² The external collateral ligament is the most important stabilizer of the posterolateral complex of the knee, along with the popliteus complex, limiting the varus and external rotation of the tibia in relation to the femur. Likewise, the bicipital tendon plays an important role in limiting the anterior translation of the fibular head. Pelc et al.² presented a patient with a divergent ankle dislocation associated with a superior dislocation of the proximal fibula caused by complete rupture of the external lateral ligament and the anterior articular capsule, as we described in our case, with an avulsion of the iliotibial band of the Gerdy tubercle as well. We add to our case complete avulsion of the bicipital tendon, which plays an important role in the stability of the proximal fibula, limiting the anterior translation. To date, a case of divergent ankle dislocation associated with a proximal dislocation of the fibula as a result of complete lesion to the external lateral ligament and the femoral biceps tendon has not been described.

Ogden¹³ described the types of proximal tibiofibular dislocation: type I occurs due to ligament laxity and, for the most part, without a history of trauma; type II is anterolateral dislocation, which occurs in up to 85% of the cases, and it what our patient presented; type III corresponds to posteromedial dislocation, it is associated with peroneal nerve injury, and is the result of direct trauma; and type IV corresponds to upper dislocation, which is uncommon and associated with high-energy ankle injuries. The case herein reported could be classified as an Ogden type-IV dislocation.

Just as Pelc et al.,² we performed a repair of the distal and proximal tibiofibular syndesmosis using suture anchor and suture-button implants. One of the main advantages of this technical repair is that it enables the temporary control of the reduction of both joints simultaneously. Another advantage is the easy control of the defects of rotational reduction because it is an elastic system, while the rigid insertion of the screw requires perfect reduction and positioning of the implant, which is of paramount importance in cases of floating fibula with complete rupture of the syndesmosis. Another reason to use this system is that it usually does not require removal of the implant and has a lower failure rate compared with fixation with screws fixation. In case of rupture, its removal is easy, and it usually does not cause periosteal reaction or heterotopic ossification, which have been observed in cases of syndesmosis repair with transsyndesmotic screws. Moreover, patients with syndesmotic injuries treated with this technique experience a faster functional recovery and return to work, as well as shorter periods of rehabilitation, than patients treated with screws.¹⁴⁻¹⁷

Conclusion

Floating fibula is a rare entity, and, to date, only one case has been described in the literature. It involves disruption of the proximal and distal tibiofibular joint, which can manifest as a high-energy trauma and may lead to great knee and ankle instability if not properly treated. Therefore, in cases of high-energy trauma to the ankle, careful examination of the ipsilateral knee is necessary.

Conflict of Interests

The authors have no conflict of interests to declare.

References

- Lamraski G, Clegg E. Unusual upward closed tibiotalar dislocation without fracture: A case report. *Foot Ankle Surg* 2010;16(02):e44–e46
- Pelc H, Carmont MR, Sutton PM, Blundell CM. Tightrope stabilisation of proximal and distal tibiofibular syndesmosis rupture: The floating fibula—A case report. *Inj Extra* 2009;40:16–18
- Alami M, Bassir R, Mahfoud M, et al. Upward tibiotalar dislocation without fracture: A case report. *Foot* 2010;20(04):149–150
- Mohamed SO, Ju W, Qin Y, Qi B. The term “floating” used in traumatic orthopedics. *Medicine (Baltimore)* 2019;98(07):e14497
- Levy BA, Vogt KJ, Herrera DA, Cole PA. Maisonneuve fracture equivalent with proximal tibiofibular dislocation. A case report and literature review. *J Bone Joint Surg Am* 2006;88(05):1111–1116
- Wang Z, Tang X, Li S, et al. Treatment and outcome prognosis of patients with high-energy transsyndesmotoc ankle fracture dislocation—the “Logsplitter” injury. *J Orthop Surg Res* 2017;12(01):3–13
- Dattani R, Patnaik S, Kantak A, Srikanth B, Selvan TP. Injuries to the tibiofibular syndesmosis. *J Bone Joint Surg Br* 2008;90(04):405–410
- Lundberg A, Svensson OK, Bylund C, Selvik G. Kinematics of the ankle/foot complex—Part 3: Influence of leg rotation. *Foot Ankle* 1989;9(06):304–309
- Edwards GS Jr, DeLee JC. Ankle diastasis without fracture. *Foot Ankle* 1984;4(06):305–312
- Imade S, Takao M, Miyamoto W, Nishi H, Uchio Y. Leg anterior compartment syndrome following ankle arthroscopy after Maisonneuve fracture. *Arthroscopy* 2009;25(02):215–218
- Mathews JR, Mutty C. Compartment Syndrome After Isolated Closed Transverse Fibular Shaft Fracture. *JAAOS Glob Res Rev* 2018;2:3077
- Lee J, Papakonstantinou O, Brookenthal KR, Trudell D, Resnick DL. Arcuate sign of posterolateral knee injuries: anatomic, radiographic, and MR imaging data related to patterns of injury. *Skeletal Radiol* 2003;32(11):619–627
- Ogden JA. Subluxation and dislocation of the proximal tibiofibular joint. *J Bone Joint Surg Am* 1974;56(01):145–154
- Thornes B, Shannon F, Guiney AM, Hession P, Masterson E. Suture-button syndesmosis fixation: accelerated rehabilitation and improved outcomes. *Clin Orthop Relat Res* 2005;(431):207–212
- Soin SP, Knight TA, Dinah AF, Mears SC, Swierstra BA, Belkoff SM. Suture-button versus screw fixation in a syndesmosis rupture model: a biomechanical comparison. *Foot Ankle Int* 2009;30(04):346–352
- D’Hooghe P, Salameh M. Does the choice of syndesmotoc screw versus suture button in ankle surgery has a silver lining? - a technical note. *J Exp Orthop* 2020;7(01):66–70
- Xie L, Xie H, Wang J, et al. Comparison of suture button fixation and syndesmotoc screw fixation in the treatment of distal tibiofibular syndesmosis injury: A systematic review and meta-analysis. *Int J Surg* 2018;60:120–131