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Isolated Hallux Dysfunction Following Tibial Intramedullary Nailing: An Underrecognized Complication

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Ioannis Papaioannou [1], Georgia Pantazidou [2], Ioanna Lianou [1], Thomas Repantis [1], Andreas G. Baikousis [1]

1. Orthopedics, General Hospital of Patras, Patras, GRC 2. Otolaryngology - Head and Neck Surgery, General Hospital of Patras, Patras, GRC

Corresponding author: Ioannis Papaioannou, john.pane1984@gmail.com

Abstract

Peroneal nerve dysfunction is an uncommon complication following intramedullary nailing of tibial shaft fractures. Isolated hallux dysfunction, characterized by weakness of the extensor hallucis longus (EHL) muscle, is even less frequently reported. These neurological deficits are often transient and may therefore be underreported in long-term follow-up studies. We present the case of a 23-year-old male patient who developed isolated hallux drop following reamed intramedullary nailing of a tibial shaft fracture. The neurological deficit persisted for several months, with gradual recovery of EHL function. At six months postoperatively, the patient had regained full EHL muscle strength, although mild residual symptoms remained. Orthopedic surgeons should be aware of this uncommon complication, its potential mechanisms, and its generally favorable clinical course.

Categories: Trauma, Orthopedics
Keywords: dropped hallux, extensor hallucis longus (ehl), intramedullary nailing of the tibia, peroneal nerve palsy, tibial fractures

Introduction

Intramedullary nailing is a widely accepted treatment for tibial shaft fractures [1]. Several complications have been associated with this fixation technique, including malalignment, infection, implant failure, delayed union or nonunion, anterior knee pain, postoperative compartment syndrome, and neurovascular injury [2].

Peroneal nerve dysfunction is a relatively uncommon complication following intramedullary nailing of tibial fractures. An even less frequently reported manifestation is isolated hallux drop, characterized by impaired active extension of the great toe, with preservation of ankle dorsiflexion and eversion. This clinical presentation may reflect selective involvement of the deep peroneal nerve or its muscular branches supplying the extensor hallucis longus (EHL) [3].

We report a case of isolated hallux drop following reamed intramedullary nailing of a tibial shaft fracture and discuss the potential mechanisms, relevant anatomical considerations, and clinical course of this complication. As the diagnosis is primarily clinical, a high index of suspicion is required for early detection of this complication and to inform the patient in detail about the natural history of this neurological deficit and its possible mechanisms, such as positioning on the fracture table, axial traction, and anatomical variations in EHL nerve branching.

Case Presentation

A 23-year-old male patient presented to our emergency department following a motor vehicle accident with closed fractures of the tibial and fibular shafts (Figure *1*).

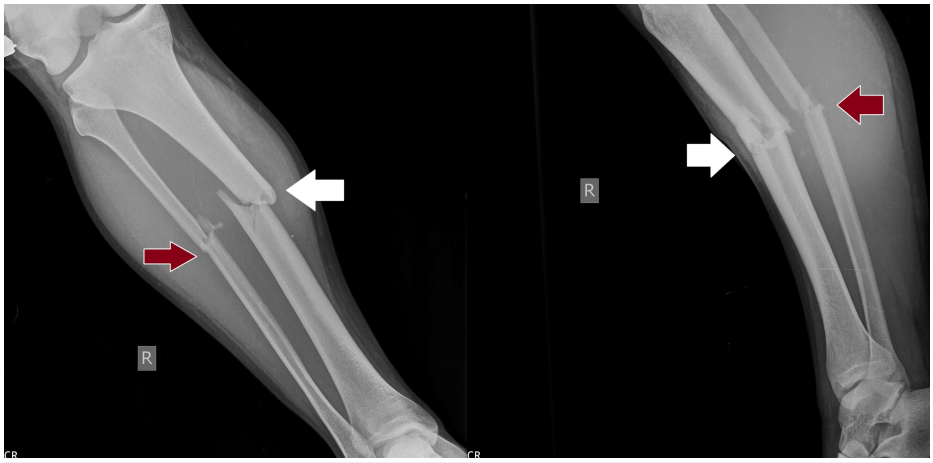


FIGURE 1: Anteroposterior and profile radiogram of the affected limb indicating the tibial (white arrow) and fibular (red arrow) fracture.

Initial clinical examination revealed no neurovascular deficits. There was no clinical evidence of compartment syndrome before surgery.

The patient underwent reamed intramedullary nailing of the tibia the following day, using a fracture table and calcaneal traction. During the procedure, the knee was flexed to approximately 90° and the hip to approximately 70°, approximating the so-called 90/90 position. A 10-mm intramedullary nail was inserted and secured with two proximal locking screws and one distal locking screw (Figure *2*).



FIGURE 2: Postoperative anteroposterior and profile radiogram indicating an adequate reduction and stabilization of the tibial fracture.

Immediately postoperatively, the patient developed isolated hallux drop, with preserved active ankle dorsiflexion and eversion (Figure *3*).



FIGURE 3: Clinical photographs showing the inability to dorsiflex the hallux (black arrow), while ankle dorsiflexion is maintained (red arrow).

Extensor digitorum longus function was also preserved. The neurological deficit was characterized by impaired active extension of the hallux and decreased sensation over the dorsal aspect of the first web space. More specifically, the EHL was completely paralyzed (muscle strength grade 0/5), while sensation in the first web space was decreased for both light touch (grade 1/2) and pinprick (grade 1/2), although sensation was preserved. The patient was discharged three days after surgery without any additional complications.

Electromyography demonstrated denervation of the EHL muscle, whereas the tibialis anterior, extensor digitorum longus, and the examined muscles of the lateral and posterior compartments showed no evidence of denervation. Abnormal sensory responses were also recorded in the first dorsal web space. Radiographic union of the fracture was achieved uneventfully at three months postoperatively (Figure *4*).

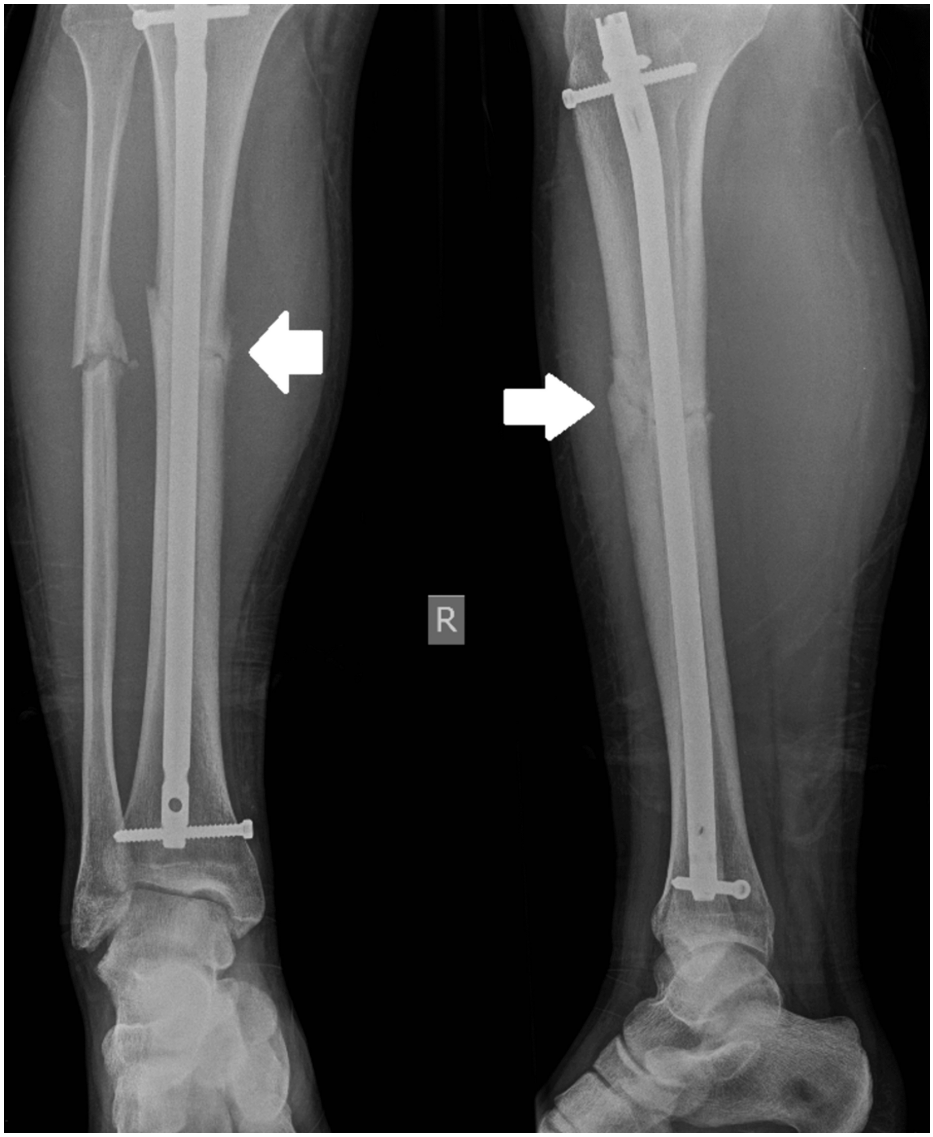


FIGURE 4: Postoperative anteroposterior and profile radiographs at the three-month follow-up demonstrating bone healing (white arrows).

At this follow-up, EHL function had partially recovered (muscle strength grade 3-4/5), while sensory grading remained unchanged.

At the latest follow-up, six months postoperatively, the patient had regained full EHL muscle strength. However, mild residual tightness in the region of the EHL and decreased sensation in the first dorsal web space persisted. Despite these residual symptoms, the patient recovered functional use of the affected limb and returned to his usual daily activities.

Discussion

Peroneal nerve dysfunction following tibial intramedullary nailing is a recognized but relatively uncommon postoperative complication. Reported rates vary considerably among studies, with an incidence of up to 30% described in some series [4,5]. However, these estimates should be interpreted in the context of differences in the definitions of neurological dysfunction, methods of assessment, and patient populations.

Isolated hallux drop is a less frequently recognized complication of tibial intramedullary nailing, with reported incidence rates ranging from 0.8% [6] to 3.8% [3] and 9% [7]. Similar neurological complications have also been described following high tibial osteotomy [8].

Several potential risk factors have been proposed, including intraoperative positioning in the 90/90 configuration, calcaneal traction, intramedullary reaming, and elevated intracompartmental pressures, including those associated with clinically unrecognized compartment syndrome [3].

In the present case, the patient was positioned with the hip and knee flexed, calcaneal traction was applied, and reaming of the tibial medullary canal was performed. No compartment syndrome was diagnosed during the perioperative period. Although these techniques are routinely used in our practice, this was the only case of isolated hallux drop encountered. Nevertheless, the exact mechanism of neurological injury could not be established.

Careful application of traction and gentle fracture reduction maneuvers may help minimize the risk of neurological injury. Excessive traction or manipulation during fracture reduction may contribute to nerve stretching or compression, particularly in anatomically vulnerable regions. However, neurological complications may still occur despite appropriate surgical technique and avoidance of recognized risk factors.

Certain anatomical characteristics of the nerve supply to the EHL may help explain its susceptibility to selective dysfunction. The EHL receives its motor innervation from the deep peroneal nerve, typically through one or more muscular branches arising relatively distally compared with those supplying the tibialis anterior and extensor digitorum longus.

An anatomical study reported a single muscular branch supplying the tibialis anterior in 12.5% of specimens, the extensor digitorum longus in 6.1%, and the EHL in 37.5% [9]. Furthermore, 81.6% of the muscular branches supplying the EHL were reported to enter the muscle from its medial aspect, close to the tibia [9]. In contrast, branches supplying the tibialis anterior and extensor digitorum longus have been described as having a more anterolateral course [10].

These anatomical variations may contribute to the vulnerability of EHL innervation during fracture reduction and intramedullary nailing. A relatively distal or medially located muscular branch may be susceptible to traction or compression associated with fracture manipulation. The presence of a single dominant motor branch could theoretically increase the risk of isolated EHL dysfunction if that branch is injured.

Nevertheless, the precise pathophysiological mechanism remains uncertain. The combination of isolated EHL weakness and sensory disturbance in the first dorsal web space observed in our patient suggests involvement of the distal part of the deep peroneal nerve. The gradual recovery of motor function over six months is consistent with a reversible neurological injury, although the available clinical and electromyographic findings do not permit definitive identification of the injury mechanism.

Conclusions

Isolated hallux dysfunction is an uncommon and potentially underrecognized neurological complication following tibial intramedullary nailing. It may result from selective involvement of the deep peroneal nerve or its branches supplying the EHL muscle. Potential contributing mechanisms include intraoperative traction, fracture reduction maneuvers, and increased intracompartmental pressure, although the precise cause may remain uncertain. Early postoperative neurological examination is essential for identifying this complication, while continued clinical monitoring is important for assessing recovery and detecting signs of compartment syndrome. Intracompartmental pressure measurement should be considered when clinically indicated, particularly when the diagnosis of compartment syndrome is uncertain, as this condition is potentially treatable. The neurological deficit may resolve gradually, as demonstrated in the present case, although residual sensory disturbances or other symptoms may persist despite full recovery of muscle strength. Awareness of this complication may facilitate early recognition, appropriate evaluation, and patient counseling regarding the expected clinical course.

Additional Information

Disclosures

Human subjects: Informed consent for treatment and open access publication was obtained or waived by all participants in this study. **Conflicts of interest:** In compliance with the ICMJE uniform disclosure form, all authors declare the following: **Payment/services info:** All authors have declared that no financial support was received from any organization for the submitted work. **Financial relationships:** All authors have declared that they have no financial relationships at present or within the previous three years with any organizations that might have an interest in the submitted work. **Other relationships:** All authors have declared that there are no other relationships or activities that could appear to have influenced the submitted work.

References

1. Alho A, Ekeland A, Strømsøe K, Follerås G, Thoresen BO: Locked intramedullary nailing for displaced tibial shaft fractures. J Bone Joint Surg Br. 1990, 72:805-9. 10.1302/0301-620X.72B5.2211761
2. Hendrickx LA, Virgin J, van den Bekerom MP, Doornberg JN, Kerkhoffs GM, Jaarsma RL: Complications and subsequent surgery after intra-medullary nailing for tibial shaft fractures: review of 8110 patients. Injury. 2020, 51:1647-54. 10.1016/j.injury.2020.04.021

3. C. M. Robinson, J. O'Donnell, E. Will, et al.: Dropped hallux after the intramedullary nailing of tibial fractures. J. Bone Joint Surg. Br. 1999, 81-B:481-4. 10.1302/0301-620X.81B3.0810481
4. Williams J, Gibbons M, Trundle H, Murray D, Worlock P: Complications of nailing in closed tibial fractures . J Orthop Trauma. 1995, 9:476-81. 10.1097/00005131-199509060-00004
5. Koval KJ, Clapper MF, Brumback RJ, Ellison PS Jr, Poka A, Bathon GH, Burgess AR: Complications of reamed intramedullary nailing of the tibia. J Orthop Trauma. 1991, 5:184-9. 10.1097/00005131-199105020-00011
6. Chalidis BE, Petsatodis GE, Sachinis NC, Dimitriou CG, Christodoulou AG: Reamed interlocking intramedullary nailing for the treatment of tibial diaphyseal fractures and aseptic nonunions. Can we expect an optimum result?. Strategies Trauma Limb Reconstr. 2009, 4:89-94. 10.1007/s11751-009-0065-0
7. Ranganathan S, Ganesan K: Dropped hallux after interlocking nailing of tibial fractures . Int J Sci Res. 2020, 9:1112-4. 10.21275/ART20204220
8. Kirgis A, Albrecht S: Palsy of the deep peroneal nerve after proximal tibial osteotomy. An anatomical study . J Bone Joint Surg Am. 1992, 74:1180-5.
9. Goral K, Marur T: The muscular branching characteristics of the deep peroneal nerve in adult human cadavers. Anat Cell Biol. 2025, 58:357-64. 10.5115/acb.25.017
10. Soejima O, Ogata K, Ishinishi T, Fukahori Y, Miyauchi R: Anatomic considerations of the peroneal nerve for division of the fibula during high tibial osteotomy. Orthop Rev. 1994, 23:244-7.