# Lower Leg Fracture Irreducibility Resulting From Entrapment of the Fibula Within the Tibial Shaft

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**Abstract**

The tibia is the most commonly fractured long bone. Tibia fractures are simple, and most are amenable to immediate closed reduction. Reported cases of irreducibility resulting from entrapment of soft-tissue structures are rare.

We report the case of a 23-year-old man who, in a high-speed motor vehicle crash, sustained a closed lower leg fracture that was later found to have a unique pattern in which the fibula was entrapped in the medullary cavity of the tibia. Limited open reduction was performed, and the entrapped distal fibula was removed with use of a bone hook. The tibia was reduced, and a nail placed in standard fashion. The postoperative course leading to full recovery was unremarkable.

This irreducible fracture pattern, not previously reported, should be considered during difficult closed reductions in order to prevent unnecessary neurovascular or bony injury.

The tibia is the most commonly fractured long bone; each year, almost 500,000 tibia fractures occur in the United States alone.[1] Low-energy mechanisms of injury usually result from torsional forces and produce less comminuted fractures. Very high-energy injuries apply direct forces to the shin and are often highly comminuted or open, owing to the limited soft-tissue envelope. The extent of soft-tissue injury occurring with these fractures is the best predictor of the development of a complication, particularly nonunion or infection.[1] Low-energy closed fractures with limited comminution and sufficient cortical apposition may be treated with closed reduction and casting, but the most common treatment for tibial shaft fractures is intramedullary nailing.[2]

In the acute setting, closed reduction allows for temporization of soft tissues and prevention of further damage to neurovascular structures. Whether eventual treatment consists of casting or intramedullary fixation, closed reduction must first be achieved.

In this article, we report a unique case of tibial shaft fracture irreducibility caused by telescoping of the distal fibula within the proximal tibial diaphysis. The patient provided written informed consent for print and electronic publication of this case report.

### *Take-Home Points*

- Preoperative orthogonal radiographs need to be carefully scrutinized in irreducible fractures.
- Open reduction is often necessary when soft-tissue or bone is interposed in a fracture site.
- The fibula's size and interosseous connection to the tibia can lead to entrapment.
- High-energy mechanisms can lead to significant deformity at time of injury, with spontaneous partial reduction prior to initial assessment.
- Consider intramedullary entrapment of adjacent long bones.

## Case Report

A 23-year-old unrestrained driver of a tow truck rear-ended another vehicle at high speed (~45 mph) and became trapped in the vehicle. Extrication time was prolonged. The driver was brought to the emergency department at a level I trauma center, where he was found to have an obvious closed deformity of the right lower leg but remained neurovascularly intact. Radiographs showed a highly comminuted fracture of the right tibial and fibular midshaft with more than 100% medial displacement of the distal fragment (**Figure 1**). Immediate closed reduction was performed in the emergency department, with the patient under sedation. The procedure improved gross realignment and reduced tension from the overlying soft tissue. Postreduction radiographs showed improved alignment that, with some displacement and angulation

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**Figure 1.** Initial anteroposterior radiograph of the injured right leg in the emergency department.

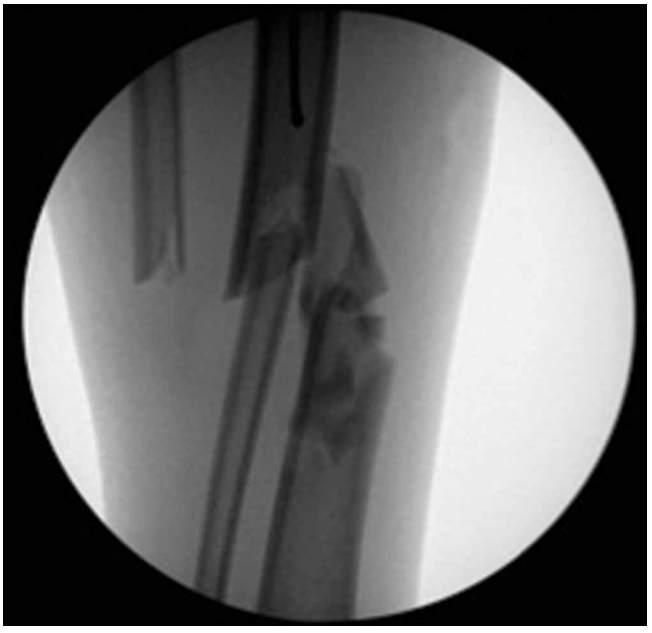

**Figure 2.** Intraoperative fluoroscopic image of the fibula entrapped in the tibial medullary cavity.

**Figure 3.** Intraoperative fluoroscopic image of the lower leg after removal of the fibular segment from the tibia.

**Figure 4.** Postoperative anteroposterior radiograph of the lower leg with intramedullary nail in place.

remaining, was deemed sufficient to temporize the injury until surgery the next morning.

The next morning, the patient was taken to the operating room for planned closed intramedullary nailing through a suprapatellar approach. After entry to the tibial medullary canal was obtained, a ball-tipped guide wire was advanced proximal to the fracture site, until significant resistance was met. With the aid of intraoperative fluoroscopic imaging, it was determined that the distal fibula fracture segment was entrapped in the medullary canal of the proximal tibia (**Figure 2**). Closed reduction and

removal of the fibula fragment were attempted multiple times, to no avail. A limited open approach was deemed necessary, and an incision was made anterior to the fracture site. The soft tissue over the fracture segment was bluntly dissected until the point of intussusception was palpated and visualized. A bone hook was used to dislodge the fibula from the tibial diaphysis (**Figure 3**).

After the fibula was liberated, additional closed manipulative reduction techniques were used on the tibia to restore length, alignment, and rotation, and an appropriately sized nail was advanced distally past the fracture segment and fixed with interlocking screws proximally and distally (**Figure 4**).

The postoperative course was uncomplicated. At most recent follow-up, radiographs showed near anatomical alignment, and the patient was back to normal activities without use of any pain medication or assistive device.

## Discussion

Although other irreducible tibia fracture patterns have been described, midshaft tibia fracture irreducibility caused by entrapment of the fibula within the intramedullary space was a previously unreported difficulty of this very common fracture. More commonly, irreducible tibia fractures are caused by entrapment of soft-tissue structures or fracture fragments.[3,4]

There are no previous documented cases of fracture patterns in which one long bone telescopes into another. Although not previously reported as occurring traumatically, the fibula was previously used as a vascularized graft in the intramedullary canal of the tibia and elsewhere.

The most well described irreducible fracture-dislocation of the lower leg is the Bosworth type, in which the proximal fragment of the fibula becomes displaced behind the tibia at the ankle joint. In addition, because of the torsional nature of most ankle fractures and the multitude of accompanying soft-tissue structures crossing at the joint, entrapment leading to irreducibility has had several different causes. These soft-tissue entrapment injures are often difficult to distinguish on plain radiographs and require further definition by computed tomography.

The high-energy mechanism of injury we have described is thought to result from lateral translation of the upper portion of the leg with the foot and lower leg fixed in place. We can posit that momentary hypervarus angulation of the tibia and the fibula with subsequent spontaneous partial reduction caused by tissue elasticity could lead to this unique injury pattern.

Although this is the first reported case of entrapment of the fibula within the intramedullary canal of the tibia, the injury should be considered when difficult closed reductions are encountered. It was only after attempted reduction for intramedullary nailing in the operating room that the telescoping fibula and the irreducibility were identified, and open reduction performed. There were no soft-tissue or neurovascular complications, but, had there been, they could have become of urgent concern and altered treatment.

In this case report, we have described a unique fracture pattern that could cause significant morbidity if not appropriately identified and treated in a timely manner.

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*This paper will be judged for the Resident Writer's Award.*