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Case Report Open Access

Complete Sciatic Nerve Transection Associated with a Closed Femoral Shaft Fracture

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Abstract

We report a rare case of a 33-year-old female patient who sustained bilateral closed femoral shaft fractures as a result of motor vehicle collision. The left femoral shaft fracture was associated with primary complete sciatic nerve palsy. The patient underwent intramedullary nail fixation of both femoral shaft fractures. Throughout the postoperative course, no functional recovery was observed. Nerve conduction studies and magnetic resonance imaging studies confirmed the diagnosis of a complete transection of the sciatic nerve at the level of the fracture site. Subsequently, the patient underwent surgical exploration and nerve grafting resulting in improved nerve function. Reports on complete sciatic nerve transections associated with closed femoral shaft fractures are limited. We document a unique injury and illustrate the patient's management and outcome.

Keywords: Trauma; Femur; Sciatic Nerve; Transection

Introduction

Femoral shaft fractures are usually the result of a high-energy injuries. It is estimated that annually between 1.0 and 2.9 million femoral shaft fractures occur worldwide. In high-income countries the annual incidence of femoral shaft fractures ranges between 8.2 and 23.9 per 100,000 people. Due to the high-energy mechanism, associated injuries are common in this patient population and the in-hospital mortality has been reported to be approximately 1.4% [1-3]. In particular, musculoskeletal injuries to the ipsilateral limb, such as hip fractures, patella fractures, tibial plateau fractures, and ligamentous knee injuries have been reported to commonly occur in conjunction with high-energy femoral shaft fracture. However, reports on peripheral nerve injuries as a result of a femoral shaft fracture are limited in the orthopaedic literature [1]. Rodriguez-Merchan et al. reported on 150 femoral shaft fractures and observed temporary neurologic deficits in 10 patients. A few case reports have reported on injuries to the sciatic nerve associated with femoral shaft fractures [4-7]. To our best knowledge, reports of a complete sciatic nerve transection associated with a closed femoral shaft fracture are exceedingly rare in the pertinent literature. The goal of this article is to illustrate a unique case of a 33 year-old female patient with a complete sciatic nerve transection as a result of a closed femoral shaft fracture.

Case Report

C.M. is a 33-year-old female, with a past medical history of hypothyroidism and anxiety. The patient was the passenger in a motor vehicle collision with rollover. She was ejected from the car and was found by the paramedics outside the vehicle. The patient was immediately transported to our level-1 trauma center. Upon arrival in the emergency department, the patient was evaluated and managed according to Advanced Trauma Life Support (ATLS) guidelines. She was found to have multiple orthopaedic and non-orthopaedic injuries. Her non-orthopaedic injuries included a concussion, a chest injury with right sided rib fractures 9-11, left grade 1 renal contusion, a scalp laceration, a right frontal bone fracture, and an intra-ocular foreign body. Her orthopaedic injuries included a left femoral shaft fracture (Figure 1), a right femoral shaft fracture, and a minimally displaced left superior ramus fracture of the pelvis. On initial examination, she was found to have 0/5 strength of her left extensor hallucis longus, flexor hallucis longus, tibialis anterior, and gastrocsoleus. The sensation was absent in the tibial and peroneal nerve distribution. She had dopplerable dorsalis pedis and posterior tibial pulses and the ankle brachial indexes were 0.8. The thigh and leg compartments were soft and compressible and without signs of a compartment syndrome. The neurovascular examination of the right lower extremity was within normal limits. Consecutive neurovascular examinations confirmed lack of motor and sensory function in the left lower extremity. A computer tomography (CT) angiography was completed and showed no damage to the femoral vessels on both sides.

Figure 1: Left femoral shaft fracture with mild comminution and displacement.

Following appropriate resuscitation, the patient was taken to the operating room for intramedullary nailing of her left femoral shaft fracture on the first day after her injury. Perioperative antibiotic prophylaxis was performed with three doses of cefazolin every 8 hours

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as per standard hospital protocol. Following successful nailing of her left femoral shaft fracture, she was found to have events of hypotension and hypoxia and the decision was made to stage the right femur intramedullary nailing procedure following further resuscitation in order to minimize the surgical burden. Postoperatively, she remained without any signs of sciatic nerve function to the left lower extremity. A lumbar magnetic resonance imaging (MRI) study was obtained and only revealed a mild left paracentral disk protrusion at the lumbar level L4-L5 without associated neural foraminal narrowing or spinal canal stenosis. The CT angiography was also specifically reviewed for the anatomy of the sciatic nerve, but did not provide conclusive information with regards to the anatomy of the sciatic nerve. At this time point, the working diagnosis was a primary neuropraxia of the sciatic nerve and the decision was made to follow the patient clinically with consecutive neurologic examinations in order to evaluate for postoperative nerve recovery. On post trauma day #5, she underwent uneventful intramedullary nail fixation of her right femoral shaft fracture. After an overall uneventful postoperative course, the patient was discharged to an inpatient rehabilitation center in a multi podus boot. The patient was placed on chemical thrombosis prophylaxis with subcutaneous enoxiparin for 6 weeks. The patient was made non weight-bearing bilateral for six weeks given the significant fracture comminution of both femur fractures. She was enrolled into early rehabilitation with immediate active and passive range of motion exercises to bilateral hip, knee, ankle and foot.

The patient was followed closely as an outpatient both by the orthopaedic and the plastic surgery service. The patient was seen as an outpatient at 2 weeks, 6 weeks, 12 weeks, and 6 months after surgery. She was advanced to weight bearing as tolerated bilaterally at six weeks after surgery. At six weeks, the patient did not show any clinical signs of a sciatic nerve recovery. An electromyography/nerve conduction study (EMG/NCS) was performed. The EMG/NCS showed a profound left sciatic nerve axonal injury involving the left tibial and peroneal nerve approximately at the level of her femur fracture. At six months after the injury, she still did not show any signs of a nerve recovery. Therefore, the decision was made to proceed with a nerve exploration. At 7 months after the injury, an MRI was obtained which did not demonstrate a clear transection of the sciatic nerve. There was, however, enlargement and increased T2 weighted signal intensity within the sciatic nerve at the level of the mid-femoral diaphysis consistent with a neuroma and increased T2 weighted signal intensity within the tibial and peroneal nerves distal to this region (Figure 2A-2C).

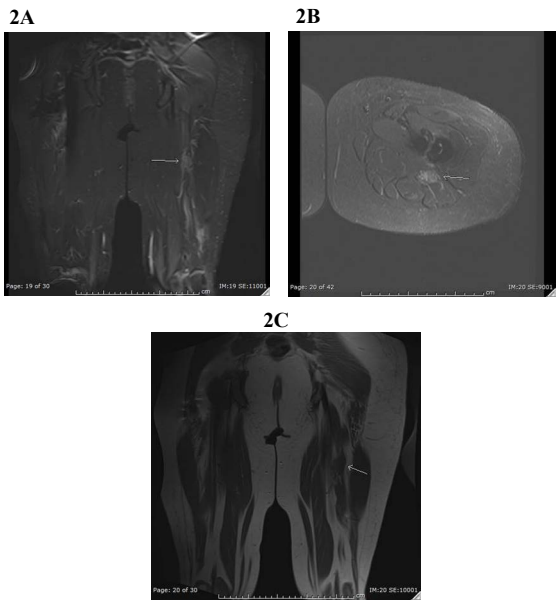

Figure 2A-C: MRI images depicting neuroma formation of sciatic nerve.

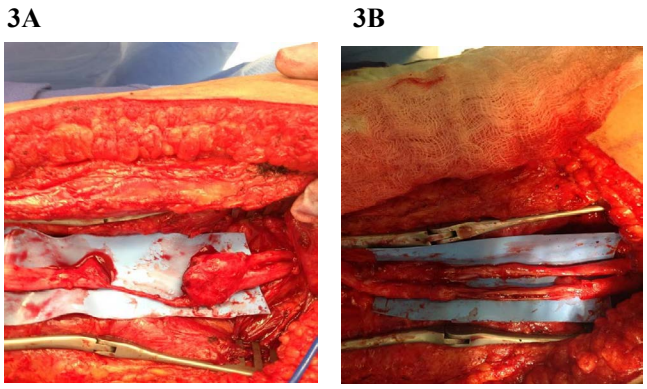

Figure 3A-B: Intraoperative photos depicting the neuroma and the subsequent repair of both divisions of the sciatic nerve.

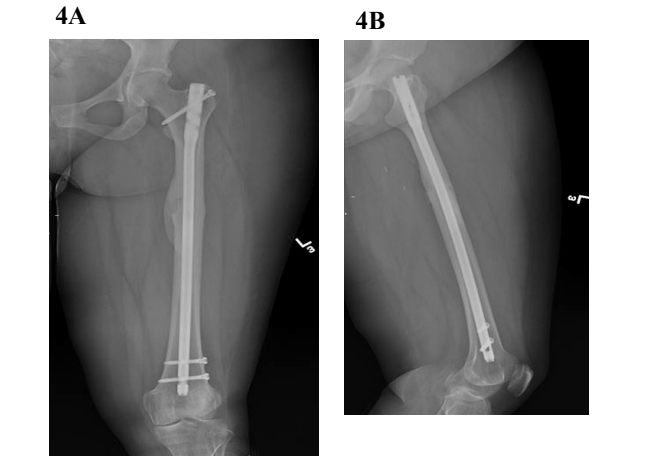

Figure 4A-B: Radiographs depicting successful healing of the femoral shaft fracture following intramedullary nailing.

Based on these results and the persistent lack of functional recovery, the patient was scheduled for surgery for a nerve exploration and a possible nerve graft by plastic surgery. In the operating room, exploration revealed a completely disrupted sciatic nerve at the level of the gluteal fold except for a single small group of fascicles. Intraoperative monitoring demonstrated no significant stimulation distal across the remaining area of fascicles. Intermittent monitoring throughout the procedure failed to demonstrate evidence of passing transmission. The sciatic nerve was then dissected out and the bifurcation was noted to be just distal to the lesion into the common peroneal and posterior tibial nerves. An ipsilateral sural nerve graft was used to repair the common peroneal nerve and a contralateral sural nerve graft was used to repair the posterior tibial nerve (Figure 3A-3B).

The patient was subsequently followed on an outpatient basis by the orthopaedic and the plastic surgery service. The femoral shaft fracture showed uneventful healing at 19 months post-injury (Figure 4A-4B). At 10 months following nerve grafting, she remained without motor function to her left lower extremity. She was found to have improved

sensation to deep pressure throughout her foot. She had a positive tinel sign in the distribution of her sciatic nerve.

Discussion

Primary neurologic injuries associated with femoral shaft fracture represent a rare event and reports in the literature on complete sciatic nerve transections associated with femoral shaft fractures are limited. Our illustrated case is a unique presentation of a patient who sustained a complete laceration of the sciatic nerve in association with a closed femoral shaft fracture. The patient required intramedullary nail fixation of the femoral shaft fracture and a subsequent nerve grafting procedure.

Reports in the literature on this unique injury pattern are limited. Rodriguez-Merchan et al. [1] reported on 150 femoral shaft fractures and observed a total of 10 neurologic injuries (four sciatic nerve, six peroneal nerve). These authors described all of these neurologic injuries to be temporary and it must be assumed that these were mostly temporary neuropraxias from stretch or contusion. In contrast, the case illustrated in this report presented as a complete sciatic nerve transection which represents a distinct difference to the temporary neuropraxias as reported by Rodriguez-Merchan et al. [1]. A report by Tomaino [5] documented a complete sciatic nerve palsy associated with an open femoral shaft fracture. Similar to the scenario in our illustrated case, an exploration was performed at six months as the authors did not observe any signs of neurologic recovery. Their exploration showed the nerve to be in continuity, but surrounded by scar tissue. A subsequent neurolysis resulted in good neurologic recovery of sensory and motor function.5 Similar to our illustrated case, Spiegel et al. [7] reported on a complete sciatic nerve laceration associated with a femoral shaft fracture. An end-to-end nerve repair of a 7 cm gap was performed and resulted in partial recovery of the nerve.

Despite the rare incidence of neurologic injuries associated with femoral shaft fractures, surgeons should maintain a high level of suspicion and thorough neurovascular documentation and compartment checks are required in these patients. In closed femoral shaft fractures, appropriate fracture treatment with subsequent observation of the nerve recovery should be considered. If the injury pattern provides sufficient suspicion of a nerve laceration, such as open fracture or stab wounds, early exploration should be considered. A tension-free end-to end nerve repair can be achieved in smaller defects. Larger defects as in our illustrated case may require a nerve graft.

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