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CASE REPORT

Sciatic transection: nerve extraordinaire with an unforeseen injury

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Objective: Closed femur fractures leading to complete transection of the sciatic nerve are rare injuries. Early clinical suspicion and an magnetic resonance imaging (MRI) of the thigh are necessary to confirm the diagnosis. Surgical intervention at the earliest is the only definitive treatment, followed by prolonged and intense rehabilitation.

Case report: A 38-year-old lady, a police constable, met with a road traffic accident. She was run over by a vehicle, inflicting a closed femur fracture in the right thigh with a complete sciatic nerve transection. She presented to the emergency department with severe thigh pain, bruising, and swelling over the thigh. On clinical examination, distal pulsations were intact, but there was a complete loss of movement below the knee. Following resuscitation, splinting, and stabilization, she was evaluated with an X-ray. A comminuted, displaced lower half of the femur shaft fracture was noticed. For motor and sensory loss below the knee, she underwent emergency MRI and sciatic neurography confirming sciatic transection at the fracture level with a gap of 4 cm between the two ends of the nerve with a large hematoma. She underwent open reduction and internal fixation (ORIF) emergently, followed by sciatic nerve repair with a sural nerve graft from the ipsilateral leg after 4 weeks.

Conclusion: Closed femur shaft fracture with sciatic nerve transection is a rare occurrence. Very few case reports are available in the literature. Early diagnosis, surgical reconstruction, and intense rehabilitation are essential for a satisfactory neurological outcome.

Keywords: sciatic nerve transection, peripheral nerve injury, neurotmesis, closed femur fracture, neurorrhaphy, sural nerve grafting

Introduction

The femur is the strongest and largest appendicular bone with significant muscle cover all around (1). Similarly, the sciatic nerve is the largest and thickest nerve in the human body and is covered by musculature all along its length. It is significantly resistant to stretch injuries (2). Only high kinetic energy injuries can lead to fracture of the femur at a young age (3). Even in these scenarios, transection of the sciatic nerve is an unusual and rare event. This is commonly seen in compound fractures where a protruding fragment of bone may cut through the nerve.

I am reporting a unique case, a closed femur fracture associated with sciatic nerve transection. Very few case reports are available in the literature confirming the rarity of the event.

Case report

A young lady, a female traffic police officer, was run over by a vehicle while on duty. She presented to the emergency department with swelling in her right thigh, pain, and inability to move the leg. The primary survey established her vitals, and her neurological status was stable, and ruling

FIGURE 1 | X-ray femur antero-posterior view showing a displaced fracture in the mid-shaft femur.

out any other injury except a closed right femur fracture. On initial clinical examination, massive swelling and bruising over the back of the lower thigh were established. Movements and sensation below the knee were absent, but the dorsalis pedis arterial pulse was intact. She was stabilized with IV fluids and analgesics.

An X-ray of the femur confirmed a comminuted mid-shaft femur fracture with a small fragment of bone displaced posteriorly (**Figure 1**). Thomas' splint stabilization was performed by the orthopedic team and was posted for open reduction in the next operative schedule. As pain settled, expected motor and sensory recovery was still absent. Hence, a neurosurgery consult was sought, and a decision to do an magnetic resonance imaging (MRI) of the thigh was taken to establish the extent of injury to the sciatic nerve.

MRI established a transection of the sciatic nerve with a gap of around 4.5 cm, with the inferior end angulated anteriorly (**Figure 2**). The decision to do femur fixation followed by delayed sciatic nerve reconstruction was taken in a multi-disciplinary meeting. The patient and family were counselled for the same.

She underwent open reduction with internal fixation of the femur on the next day. After 3 weeks, she was admitted for sciatic nerve reconstruction with a sural nerve cable graft from the same leg. Pre-procedure X-ray confirmed adequate reduction and stabilization of the fracture site (**Figure 3**). In the prone position, the whole length of the sural nerve graft was harvested, around 40 cm in length. The mid- and lower

FIGURE 2 | Magnetic resonance imaging (MRI) thigh T2-weighted axial image showing a large hematoma with lacerated sciatic nerve ends and a displaced fracture of the mid-shaft femur.

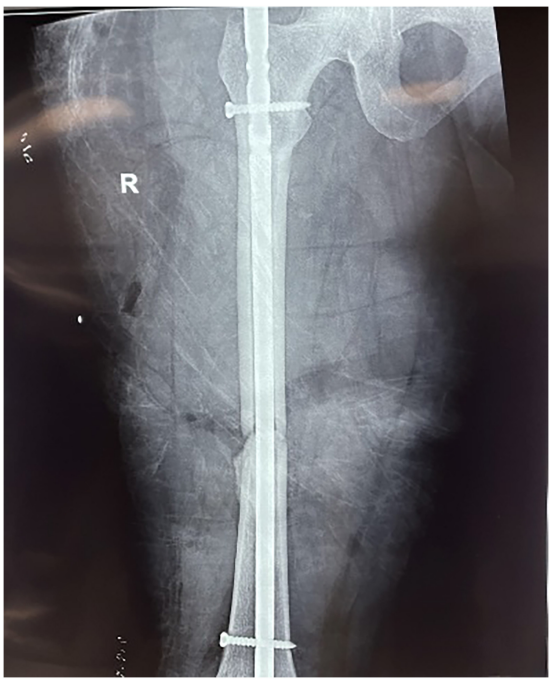

FIGURE 3 | X-ray femur antero-posterior view showing post-fixation of femur shaft fracture reduced with intramedullary interlocking nail in situ.

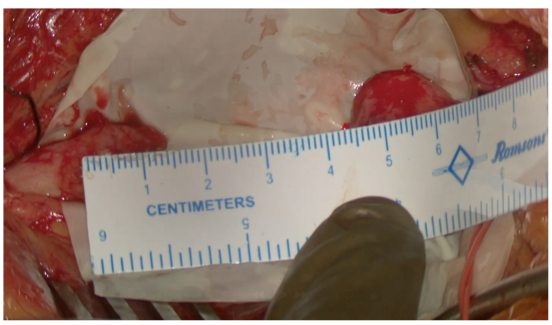

FIGURE 4 | Intra-op picture showing sciatic nerve transection with neuroma formation at both proximal and distal ends with a gap of 5 cm.

thighs were incised in the midline and through the inter-muscular plane, proximal and distal ends of the sciatic nerves were identified. Neuroma was identified both proximally and distally (**Figure 4**), which was transected to see the fresh cut ends of the nerve. The distal end of the nerve was buried partially in the muscle, and both ends were adequately dissected to increase length for tension-free anastomosis. The sural nerve was inverted from distal to proximal and made into 4 wide cable grafts to cover the surface area of the cut end of the sciatic nerve. A 9-0 Ethilon suture was used for achieving good fascicular alignment with a single reef knot placed for each cable graft. After proximal and distal sutures, both ends were covered in tissue glue (**Figure 5**). Hemostasis was confirmed, and the wound was closed in layers.

The patient was immobilized for 3 weeks with a slab to avoid tension on sutured cable grafts, following which she

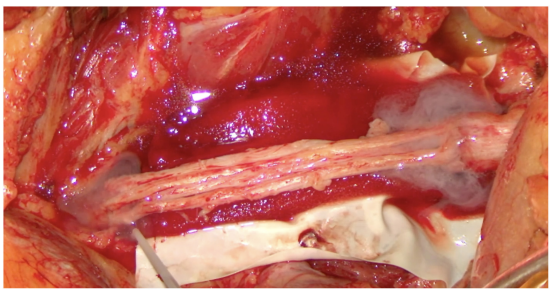

FIGURE 5 | Sural nerve cable graft reconstruction of sciatic nerve cut ends with sutures and fibrin tissue glue.

started intense neurorehabilitation with initially range-of-motion exercises and muscle strengthening. After 3 months, galvanic stimulation was started. At 2 years of follow-up, she has recovered 5/5 power in knee flexors and ankle plantar flexors. Ankle eversion and dorsiflexion are still weak with failure of common peroneal reinnervation. She can walk with the help of an anti-foot-drop splint independently and has joined back police duty with acceptable functional limitations.

Discussion

This is a stand-alone case of traumatic sciatic nerve transection in a closed femur fracture. The sciatic nerve is one of the thickest and strongest nerves surrounded by strong musculature in the mid-thigh (2, 3) and is not closely related to the femur bone, contrary to the radial nerve and humerus. The overall prevalence of sciatic nerve injury following femur fractures is as low as 0.4% (3), compared to radial injury with humerus fracture at 7–17% (4).

Sciatic nerve transection occurring alongside a closed femur fracture is exceptionally uncommon, as these nerve injuries most often happen with compound fractures. In contrast, when the femur fracture is closed, stretch injuries to the sciatic nerve are more frequently observed. There is only anecdotal evidence in the literature on closed fractures with complete lacerations, and as the incidence is low with limited reporting, consensus on the management protocol of such injuries is still elusive.

Diagnostic work-up in traumatic nerve injuries involves thorough clinical examination, nerve conduction studies, and radiological evaluation with ultrasonography and/or magnetic resonance neuronography. As lesions in continuity are a common form, electrodiagnostics and serial clinical follow-up with watchful waiting as an initial treatment strategy are not uncommon. But this can lead to significant delay in definitive treatment like nerve reconstruction and, in turn, can lead to poor neurological and functional outcomes. Emamhadi et al. reported on the timing of surgery following sciatic injury, where they reported that delayed repair was associated with significantly poorer outcomes in motor recovery (3).

TABLE 1 | Cases reported in literature with closed femur fracture with sciatic nerve transection.

No.	Author	Demo-graphic	Segment of sciatic	Timing of surgery	Follow-up	Outcome
1.	Spiegel et al. (11)	22 male	Sciatic	5 weeks	6 years	Hamstring good, ankle plantarflexion +, dorsiflexion weak
2.	Takami et al. (2)	Young male	Common peroneal (direct repair)	11 months	7 years	Walking a limited distance without support
3.	Zelle et al. (12)	22 female	Sciatic (bilateral sural graft)	7 months	10 months	No recovery
4.	Jhonston et al. (9)	40 male	Sciatic (5 cm gap, sural nerve graft)	-	14 months	Ankle plantarfelxion + Dorsiflexion −
5.	Present case	38 female	Sciatic	4 weeks	2 years	Knee flexion 5/5 Ankle plantarflexion 4+/5 Dorsiflexion 0/5

As is the case with most nerve injuries, electrodiagnostics and physical examination have a limited role in the first few weeks of injury in decision-making, and they cannot differentiate between neuropraxia, axonotmesis, and neurotmesis (5, 6).

Early radiological evaluation is the only way to confirm the continuity of the nerve. Ultrasonography is an easily available bedside diagnostic tool, but to an ext, ent operator operator-dependent (7). In the settings of trauma, limited visualization due to large hematomas, an uncooperative patient due to pain, or in situ orthopedic slabs or plasters are real-world limitations to ultrasound imaging of the nerves. MRI is the gold standard for establishing nerve integrity and injury (8). But it involves a higher cost and requires longer acquisition time. In an unstable patient, especially in polytrauma, transportation and urgency can be a hindrance to MRI acquisition. Fortunately, our patient was clinically stable and had an isolated thigh injury; hence, after initial pain relief and stabilization of the fracture, we allowed the opportunity to perform an MRI of the sciatic nerve.

Surgical repair of a transected sciatic nerve with an interposing cable graft is the treatment of choice. Even if there is no conclusive evidence of nerve injury on MRI in a suspected high-grade nerve injury and a lack of clinical or electro-physiological recovery during the period of observation, surgical exploration is mandatory (9). Delayed repair after 3–4 weeks of injury allows time necessary for the process of neuroma formation to complete and prevents coaptation of injured nerve ends. It leads to failure of adequate axonal regeneration and consequential neurological recovery (5). At the same time, intervention beyond 3 months results in limited neurological recovery (6). Also, suture repair with a nerve graft showed functional motor recovery more in the case of the tibial component compared to the peroneal part of the sciatic. This differentiation in recovery pattern is noted, probably due to the inherent potential and limited number of axons seen in the peroneal component compared to the tibial nerve (10). At 24 months post-surgery, our patient has shown recovery in the tibial component with persistent weakness in the peroneal component.

In published literature in the English language, only four publications (**Table 1**) exist mentioning closed femur fracture with sciatic nerve transection so far (2, 9, 11, 12). In these, three cases have complete sciatic transection, while Takami et al. reported only common peroneal laceration. All reported cases had variable timing of surgery and outcomes as mentioned in **Table 1**. This is the fifth such reported case in the literature with complete recovery of the tibial component and weak common peroneal component at the end of 2 years.

Conclusion

Early suspicion and timely intervention are key in functional recovery for any nerve injury. In case of rare forms of injuries like transections with closed fractures, radiological evaluation along with clinical suspicion and nerve exploration and repair with primary suturing or with cable grafts at 3–4 weeks is ideal for good functional recovery.

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Author contributions

UY: Idea, Research, Writing, Editing.

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Conflict of interest

The author declares that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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