

## General

# Postoperative Sciatic Neuropathy Following Ankle Surgery and Peripheral Nerve Blockade: A Case-Based Review

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Peripheral nerve blocks are commonly used for intraoperative and postoperative analgesia in foot and ankle surgery due to superior pain control and opioid-sparing effects. Although considered safe, neurologic complications can occur and present diagnostic and management challenges for the anesthesiologist. This case-based educational review describes a 72-year-old patient who developed persistent postoperative sciatic-distribution motor and sensory deficits after ankle open reduction and internal fixation performed with adductor canal and popliteal sciatic nerve blocks. The clinical scenario highlights the difficulty of determining causation when neurologic deficits arise in the setting of regional anesthesia, surgery, tourniquet use, and patient-specific risk factors. Through this clinical scenario, key perioperative considerations are reviewed, including risk factors for nerve injury, recognition of abnormal block recovery, diagnostic evaluation, and evidence-based management strategies. This structured case discussion is designed for anesthesiology trainees and perioperative clinicians to support safe regional anesthesia practice and early identification of neurologic complications.

### TEACHING CASE

A 72-year-old woman with hypertension, well-controlled type 2 diabetes mellitus, and hyperlipidemia presented after a mechanical fall resulting in a displaced trimalleolar ankle fracture. She was scheduled for open reduction and internal fixation of her injured ankle. Preoperative neurologic examination of the operative extremity revealed intact sensation and motor strength. There was no history of peripheral neuropathy symptoms, although she had a 10-year history of diabetes.

For postoperative analgesia, the anesthesia team performed an ultrasound-guided adductor canal block and popliteal sciatic nerve block prior to induction of general anesthesia. A total of 30 mL of 0.5% ropivacaine was administered (15 mL per block). In-plane ultrasound-guided approach was utilized and needle visualization was reported as adequate. No paresthesia or pain was elicited during injection, and aspiration was negative. Injection pressures were not objectively monitored.

The patient underwent uneventful general anesthesia and ankle ORIF with tourniquet use for 94 minutes. She was hemodynamically stable throughout and did not require any additional opioids prior to emergence and extubation. In the PACU, the patient reported minimal pain, consistent with a functioning block. However, on postoperative day (POD) 1, she continued to have dense numbness

of the foot and weakness with inability to dorsiflex or plantarflex the ankle. By POD 2, the block had not regressed as expected. She described burning dysesthesias in the posterior calf and foot.

Pertinent physical exam findings:

Foot drop with significant weakness in dorsiflexion

Weak plantarflexion

Decreased sensation over the lateral leg and plantar foot

Sensation to medial leg and ankle intact

Intact pulses and soft compartments

Concern was raised for a sciatic nerve injury.

### TEACHING QUESTIONS

#### QUESTION 1

Which feature most strongly suggests a peripheral nerve injury rather than prolonged local anesthetic effect?

- A. Numbness lasting longer than 12 hours
- B. Presence of motor weakness
- C. Severe neuropathic pain and dysesthesia after the expected block duration
- D. Reduced sensation in the area of surgical intervention

## QUESTION 2

What is the most appropriate next step when persistent neurologic deficits are noted after a peripheral nerve block?

- A. Reassure the patient and wait 7 days
- B. Immediate surgical exploration
- C. Focused neurologic exam and early referral to neurology with electrodiagnostic planning
- D. Start opioids for pain control

## QUESTION 3

Which mechanism is most strongly associated with severe injection-related nerve injury during peripheral nerve blockade?

- A. Local anesthetic allergy
- B. Direct intraneural or intrafascicular injection producing mechanical injury, elevated intraneural pressure and ischemic injury
- C. Sterile inflammation from ultrasound gel
- D. Systemic hypotension

## QUESTION 4

Which patient factor increases susceptibility to nerve injury after regional anesthesia?

- A. Young age
- B. Diabetes mellitus
- C. Low BMI
- D. Controlled hypertension

## QUESTION 5

What is the cornerstone of management for most block-related nerve injuries without compressive lesions?

- A. Emergent surgical decompression
- B. High-dose IV antibiotics
- C. Multimodal neuropathic pain control and early physical therapy
- D. Repeat regional block to relieve pain

## ANSWERS AND DISCUSSION

## QUESTION 1

Correct Answer: C

When assessing patients who have received a regional block, clinicians must be able to distinguish the difference between an expected motor or sensory deficit and a true nerve injury. The duration of sensory and motor blockade varies depending on the local anesthetic, dose, adjuncts, and patient factors. Long-acting agents such as ropivacaine or bupivacaine can produce sensory blockade for 12–24 hours.

Early signs of potential nerve injury may include persistent sensory deficit or motor weakness that extends beyond the expected time frame. However, these signs are less specific for nerve injury when compared to the development of new neuropathic pain such as burning sensations, electric

shocks, hyperalgesia, or allodynia. New-onset neuropathic pain are not typical and strongly raises concern for nerve injury.<sup>1,2</sup> In uncomplicated block resolution, sensation returns gradually, motor function improves steadily, and pain reflects surgical tissue injury rather than neuropathic characteristics. In contrast, neuropathic symptoms indicate abnormal nerve signaling due to inflammation, ischemia, or structural injury.

New-onset neurological symptoms in distributions not expected to be affected by the nerve block are also atypical and may be a sign of non-block injury. These features should prompt immediate reassessment rather than reassurance alone.

## QUESTION 2

Correct Answer: C

Timely recognition and documentation of neurologic deficits is essential for both patient care and medicolegal protection. If neurological injury is suspected, the initial step is a thorough neurologic examination to characterize motor, sensory, and reflex abnormalities and define the distribution of injury (e.g., sciatic vs common peroneal vs tibial nerve).

Early consultation with neurology or a peripheral nerve specialist is recommended. Although EMG and nerve conduction studies are often most diagnostically useful after Wallerian degeneration occurs (typically 2–3 weeks post-injury), early involvement ensures appropriate timing of studies and follow-up.<sup>2,3</sup>

While the treatment of patient pain is important, the use of high dose opioids may mask symptoms and interfere with obtaining an accurate neurological evaluation. Opioids, used in conjunction with a multimodal analgesic regimen, should be prescribed after a thorough examination has been conducted.

Nerve injury secondary to a peripheral nerve block is typically not a surgical emergency and does not necessitate emergent surgical exploration in the absence of a compressive lesion or rapidly progressive neurologic deterioration. Ultrasound or MRI neurography can help identify compressive hematoma, abscess, or severe nerve swelling, which may necessitate surgical decompression.

## QUESTION 3

Correct Answer: B

Peripheral nerve injury after regional anesthesia is usually multifactorial. When the injury is directly related to injection, intrafascicular needle placement and injection under elevated pressure are considered particularly concerning because they may produce mechanical disruption, ischemia, and local anesthetic-mediated neurotoxicity.<sup>4</sup> Factors that can affect the degree or incidence of nerve injury include needle type/size/length, site of insertion, angle of insertion, pressure of injection, and type/dose/concentration of the local anesthetic being used.<sup>4</sup>

Most drugs, including all local anesthetics, have been shown to cause nerve injury when injected intrafascicularly.<sup>4</sup> Intraneural injections do not always produce imme-

diate pain or paresthesia, especially in elderly or diabetic patients with reduced sensation. Likewise, negative aspiration does not exclude intraneural placement.

High pressures achieved during intraneural injections have been shown to cause neuronal injury.<sup>4</sup> Injury has been shown with both local anesthetic as well as saline in fresh cadaver models, demonstrating that nerve injury is secondary to increased intraneural pressure leading to ischemia rather than drug toxicity alone.<sup>4</sup> The avoidance of intraneural injections and the use of a manometer to measure injection pressures can help decrease the incidence of complications.

The use of ultrasound guidance needle techniques in regional anesthesia have revolutionized the field by improving both safety and needle precision.<sup>5</sup> However, ultrasound guidance helps visualize spread but cannot reliably distinguish extrafascicular from intrafascicular injection at all times.<sup>6,7</sup>

Local anesthetic allergic reactions during regional blocks are rare. It presents with cutaneous flushing, urticaria, edema, and may escalate to hypotension, tachycardia, bronchospasm, and airway edema. IgE-mediated reactions are extremely rare and most reactions during regional blocks are non-allergic in nature. Local anesthetic allergies are not a known cause of peripheral nerve injury.

Sterile inflammation from ultrasound gel has not been implicated as the main mechanism for neuropathy after PNB.

#### QUESTION 4

Correct Answer: B

Diabetes is a well-established risk factor for perioperative nerve injury. Chronic hyperglycemia leads to microvascular insufficiency, axonal degeneration, and impaired nerve repair capacity. Even in patients without overt neuropathy symptoms, subclinical nerve dysfunction may be present, lowering the threshold for injury from compression, ischemia, or injection-related trauma.<sup>8</sup>

This concept is often referred to as the “double crush” phenomenon, where a nerve compromised by metabolic disease is more susceptible to secondary injury. Advanced age similarly reduces regenerative capacity and increases vulnerability to ischemia.

High BMI and obesity (defined as BMI > 30 kg/m<sup>2</sup>), not low BMI, is found to be associated with higher rates of acute neurological complication following a peripheral nerve block.<sup>9,10</sup> These individuals were also found to have a higher risk of a failed regional block.<sup>9</sup>

These patient-related factors do not contraindicate regional anesthesia but should prompt meticulous technique, avoidance of high injection pressures, and careful perioperative monitoring.

#### QUESTION 5

Correct Answer: C

The majority of peripheral nerve injuries associated with nerve blocks are neuropraxic or mild axonotmetic injuries and improve over weeks to months. Management is primar-

ily supportive and aims to preserve function and minimize chronic pain development. Key components include:

##### 1. Neuropathic Pain Management

Medications such as gabapentin, pregabalin, duloxetine, or tricyclic antidepressants help modulate abnormal nerve signaling and improve quality of life.<sup>11-13</sup> Early treatment of neuropathic pain may reduce central sensitization.

##### 2. Physical Therapy

Early mobilization and targeted therapy prevent muscle atrophy, joint stiffness, and contractures. For foot drop, an ankle-foot orthosis helps maintain safe ambulation and prevents falls.

##### 3. Serial Neurologic Assessment

Follow-up examinations and repeat EMG/NCS track recovery. Evidence of reinnervation on EMG is a favorable prognostic sign.

##### 4. Surgical Referral

Reserved for patients with imaging evidence of compressive lesions, nerve transection, or lack of clinical/electrophysiologic improvement over 3–6 months.<sup>2,14</sup>

Education and reassurance are also crucial. Most patients experience gradual improvement, though recovery may be incomplete, particularly in those with underlying neuropathy.

Surgical decompression is not indicated in the absence of a compressive lesion. High dose IV antibiotics do not play a role in the absence of a known infection. In the setting of known nerve injury, a second regional block would not be appropriate, as this can potentially lead to a “double crush” phenomenon.

#### CONCLUSION

This case-based review was developed as an educational teaching scenario rather than a report of an actual patient. It was designed to illustrate the recognition, differential diagnosis, evaluation, and management of a possible peripheral nerve injury following regional anesthesia. Although the clinical presentation emphasizes neuropathy occurring after a popliteal sciatic nerve block, postoperative neurologic deficits occurring after regional anesthesia should not automatically be attributed to the nerve block. Potential etiologies include surgical trauma, traction, positioning, tourniquet-related injury, compressive dressings, hematoma, compartment syndrome, preexisting neuropathy, and inflammatory postsurgical neuropathy, in addition to needle- or injection-related injury. In many cases, a single definitive cause cannot be established. Evaluation should therefore focus first on identification, excluding reversible or time-sensitive causes, and documenting the temporal evolution of symptoms rather than assigning causation prematurely. Early recognition, careful neurologic examination, timely specialist involvement, appropriate diagnostic testing, multimodal symptom management, and rehabilitation remain central to optimizing outcomes. Ultimately, this teaching case highlights the importance of maintaining a broad differential diagnosis when neurologic deficits occur after surgery performed with regional anesthesia, as the underlying cause may reflect the nerve block,

tourniquet use, surgical injury, patient-specific vulnerability, or a combination of factors.

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