Case Report / Olgu Sunumu

An Unusual Case of Footdrop: Bilateral Common Peroneal Nerve Palsy by One Bullet Gunshot Injury

Sıradışı Bir Düşük Ayak Olgusu: Tek Kurşun Yaralanması ile Bilateral Peroneal Sinir Paralizisi

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Abstract

Common peroneal nerve injuries represent the most common nerve lesions of the lower limbs. Peroneal palsy might be due to traumatic origin. However, bilateral peroneal nerve involvement in an injury is rarely seen in clinical practice. Here, the first case report of a bilateral peroneal nerve paralysis after gunshot injury is presented.

Keywords: Common peroneal nerve, gunshot injury, foot drop, peripheral neuropathy, rehabilitation, bilateral common peroneal nerve injury

Introduction

Foot drop is an index symptom with a broad differential diagnosis including cerebral, spinal, and peripheral causes. By history taking and careful clinical examination, neurotopographic classification is usually possible. Peroneal palsy is a frequent cause of foot drop, mostly due to pressure on the fibular neck just below the knee (1). The peroneal nerve is located superficially in a 4 cm area of the head and neck of the fibula and innervates the short head of the biceps femoris in the thigh, travels down the leg to the lateral cutaneous nerve at the knee, before it passes through the fibular tunnel and the peroneus longus muscle and the fibula. Acute injury to the peroneal nerve is a rare occurrence due to trauma, surgery or postural entrapment of the nerve at the fibular head (2,3,4,5). Traumatic nerve injury results from the application of kinetic energy to the nerve with consequent compressive and tensile forces applied to the nerve.

Case Report

A 34-year-old man was admitted to our inpatient clinic with a diagnosis of bilateral foot drop reporting weakness in his feet and difficulty in walking. He had a gunshot injury at knee level one month ago in which a single bullet penetrated both knees respectively (Figure 1). Foot drop and numbness over the lower anterolateral aspect of the legs and the dorsum of the feet had immediately developed following the gunshot injury. His initial evaluation had been performed in the emergency room and no vascular injury or bone fracture had been detected. Other physical examination and laboratory findings were unremarkable.

In the clinical examination, he had prominent steppage gait caused by a weakness of 2/5 muscle strength in ankle dorsiflexion, and eversion and extension of toes in both legs in manual muscle testing without loss in deep tendon reflexes and sensation. Plantar flexion and inversion was normal. Besides these, bilateral Achilles contracture was identified in the neutral
position. Electromyography (EMG) was studied one month after the injury, which revealed a decreased amplitude of the compound motor action potential on stimulation of the common peroneal nerves, confirming bilateral severe common peroneal nerve axonal degeneration (Tables 1, 2).

A physical therapy and rehabilitation program including neuromuscular electrical stimulation of denervated muscles and exercises were directed to increase range of motion (ROM) and muscle strength. The exercise program, progressing from passive ROM to passive assistive, active, active resistant, and strengthening exercises for the lower limbs were initiated. Toe curls, toe-to-heel rock, foot stretch, isometric dorsiflexion, and cycling were also added to the program. Achilles stretching exercises and walking adaptation were guided by a therapist. For the Achilles contracture, superficial and deep heating modalities were also added to the program. Therapeutic ultrasound was performed 1 w/ cm$^2$ for five minutes per day. The patient was adapted to bilateral rigid plastic ankle foot orthoses (AFO) and the positioning of the ankles was described to keep the foot dorsiflexed. After five weeks of the rehabilitation, muscle strength for dorsiflexors and evertors improved to 3/5 with a wider ROM in the ankles. He had a better walking pattern with AFO in both legs.

Follow-up EMG was performed three months after the gunshot injury. EMG of the anterior tibial muscle revealed moderate to profuse denervation at rest and a few small polyphasic motor unit potentials on volitional contraction, demonstrating findings indicative of reinnervation of the motor units. There was moderate atrophy of the anterior compartment of the lower legs. A physical examination revealed that muscle strength for dorsiflexors and evertors remained 3 out of 5. We recommended an evaluation for surgical treatment within six months.

**Discussion**

The mechanisms of foot drop are various such as neurologic, muscular, and anatomic, and the treatment is directed at the specific cause. Numerous injury mechanisms including stretch/contusion, traction, laceration, entrapment, and compression can play a role in bilateral common peroneal nerve palsy. As a traumatic nerve injury, the bullet passing through the tissues with high velocity caused a gunshot wound with associated kinetic energy to the nerve and a cavitation effect (6).

Acute footdrop is described as difficulty of dorsiflexing the foot against gravity. Patients may also have sensory loss over the dorsum of the foot (4). Symptoms of pain are also rare at rate of 17% (7). Electrodiagnostic studies assist with confirming the diagnosis of peroneal neuropathy and evaluating prognosis. Motor nerve conduction studies of the peroneal nerve and tibial nerve, and sensory nerve conduction studies of the sural and superficial peroneal nerves are recommended. Motor nerve conduction studies are most often performed to the extensor digitorum brevis. The lesion may be better localized using needle EMG. Demyelinating nerve injuries have a better prognosis than axonal lesions (8).

The initial treatment of a peroneal neuropathy is typically conservative management and includes a variety of interventions such as stretching, ROM exercises, and strength training. Proper

### Table 1. Nerve conduction study of the right and left extremity nerves

| Nerve         | Stimulation       | Right Latency (ms) | Right Amplitude (mV) | CV (m/s) | Left Latency (ms) | Left Amplitude (mV) | CV (m/s) |
|---------------|-------------------|--------------------|----------------------|----------|------------------|---------------------|----------|
| Motor Peroneal at EDB | Ankle            | NR                 | NR                   | -        | NR               | NR                  | -        |
|               | Below the fibular head | NR                 | NR                   | -        | NR               | NR                  | -        |
|               | Above the fibular head | NR                 | NR                   | -        | NR               | NR                  | -        |
| Peroneal at TA | Below the fibular head | NR                 | NR                   | -        | NR               | NR                  | -        |
|               | Above the fibular head | NR                 | NR                   | -        | NR               | NR                  | -        |
| Tibial        | Ankle             | 3.55               | 10.5                 | -        | 3.55             | 10.6                | -        |
|               | Popliteal fossa   | 11.5               | 6.3                  | 40       | 11.2             | 7.1                 | 41       |
| Sensory       | Sural             | 3.7                | 11.9                 | 36       | 3.40             | 12.8                | 36       |
|               | Superficial peroneal | Lateral leg         | NR                   | NR                   | -        | NR               | NR                  | -        |

EDB: Extensor digitorum brevis, TA: Tibialis anterior, NR: No response, CV: Conduction velocity
physical therapy exercises can strengthen ankle muscles and improve symptoms. AFOs are also important devices for patients who have severe foot drop of any reason, they enable patients to walk better and more safely. Therapeutic ultrasound and stretching exercises may be helpful because Achilles contracture is expected to develop (9). Surgical decompression with a meticulous approach should be preserved for failed cases 3-7 months following injury (10). A one-stage procedure of nerve repair and tibialis tendon transfer can enhance neural regeneration and result in a fixed equinism. However, nerve regeneration after common peroneal nerve repair is poorer when compared with other peripheral nerves because the mobility and elasticity of the peroneal nerve is lower than in other peripheral nerves (11,12).

Acute peroneal nerve injury was diagnosed in our patient through clinical and electrophysiologic studies. Conservative treatment was initially considered under follow-up with EMG and physical examination. In the following three months, electrophysiologic and clinical healing was observed.

In conclusion, there are many causes and treatments for foot drop, and each individual patient requires different procedures depending on their specific cause and conditions.

Ethics
Informed Consent: Informed consent was given by the patient.

Peer-review: Externally peer-reviewed.

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Table 2. Needle electromyography study in the left and right lower extremity

| Muscle                        | IA     | ASA     | MUAP | Recruitment pattern |
|-------------------------------|--------|---------|------|---------------------|
| Paraspinal muscles (L3-S1)    | R: Normal | R: None | -    | -                   |
|                               | L: Normal | L: None | -    | -                   |
| Gluteus medius                | R: Normal | R: None | R: Normal | R: Full |
|                               | L: Normal | L: None | L: Normal | L: Full |
| Vastus medialis               | R: Normal | R: None | R: Normal | R: Full |
|                               | L: Normal | L: None | L: Normal | L: Full |
| Biceps femoris (short)        | R: Normal | R: None | R: Normal | R: Full |
|                               | L: Normal | L: None | L: Normal | L: Full |
| Tibialis anterior             | R: Normal | R: + +  | R: + L: + | R: No activity |
|                               | L: Normal | L: ++   | L: No activity | - |
| Peroneus longus               | R: Normal | R: + L: + | R: - L: - | R: No activity |
|                               | L: Normal | L: No activity | - | - |
| Peroneus brevis               | R: Normal | R: + L: + | R: - L: - | R: No activity |
|                               | L: Normal | L: No activity | - | - |
| Tibialis posterior            | R: Normal | R: None | R: - | R: Full |
|                               | L: Normal | L: None | L: - | L: Full |
| Gastrocnemius (medial)        | R: Normal | R: None | R: Normal | R: Full |
|                               | L: Normal | L: None | L: Normal | L: Full |

IA: Insertional activity, ASA: Abnormal spontaneous activity, MUAP: Motor unit action potential, R: Right, L: Left

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