

You're the Flight Surgeon

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You're the flight surgeon in a primary care clinic. A 32-yr-old male pilot presents for follow-up after treatment of acute-on-chronic back pain with physical therapy for a few months. He reports chronic back pain for 7 yr. Acute worsening of his back pain started 3 mo ago. Today on follow-up he reports his back pain has returned to the baseline prior to recent exacerbation.

During evaluation of his back pain, weak left ankle dorsiflexion is found on exam. The patient admits to a history of catching his left toe for the past 3–5 yr. It is worse when he wears less supportive footwear such as sandals or when he is on soft surfaces such as sand or thick carpet. He denies any other symptoms of muscle weakness, tremor, sensory loss, or paraesthesia. He currently flies a military C-12 (modified Beechcraft King Air).

1. Other than L5 radiculopathy, which of the following is the most common cause of foot drop?

- A. Peroneal nerve injury.
- B. A lesion in the sciatic plexus.
- C. Central lesion such as injury to the motor cortex.

ANSWER/DISCUSSION

1. A. Peroneal neuropathy is a common cause of foot drop.⁶ This is due to the relative vulnerability of the peroneal nerve. The nerve's course is superficial to the fibular head with only dermal and subdermal tissue overlying it, making it vulnerable to compression. Additionally, the nerve can be affected by trauma to the knee or fibular head such as fracture. Other lesions, including central and sciatic, are possible, but are less common.^{1,6} Additionally, lesions proximal to the peroneal nerve are more likely to present with other neurological findings than isolated foot drop.

Additional questioning reveals the patient is a former helicopter pilot with approximately 2000 flight hours. He admits to a habit of bracing his left knee against the collective (a flight control in the cockpit) when flying helicopters. In some instances, this was to prevent the collective from unexpectedly moving. Most other times, it was to rest his leg against something. Typically, the positioning of the patient, his leg, and the collective would result in pressure to the region around the left fibular head.

2. In this patient, who also has a history of back pain, what physical exam finding is NOT expected to distinguish foot drop due to peroneal nerve pathology vs. L5 radiculopathy?

- A. Foot inversion.
- B. Toe extension.
- C. Hip abduction.
- D. Hip internal rotation.

ANSWER/DISCUSSION

2. B. Toe extension, foot eversion, and foot dorsiflexion weakness can all occur in peroneal neuropathy or L5 radiculopathy. Muscles involved in foot inversion, hip abduction, and hip internal rotation may be affected in L5 radiculopathy, but are not innervated by the peroneal nerve.⁶ Foot inversion in a seated position and hip abduction in a side lying position are particularly helpful in distinguishing peroneal neuropathy from L5 radiculopathy.^{3,6}

Vital signs are within normal limits. General appearance and cardiovascular, pulmonary, and abdominal exams are normal. Back exam shows full range of motion, normal alignment, no tenderness to palpation, and negative straight leg raise. Atrophy of the left anterior compartment of the leg is observed. Left ankle dorsiflexion strength is 4/5 and left great toe extension strength is 2/5; otherwise, 5/5 strength is observed throughout, including foot inversion and hip abduction. There is normal sensation to pinprick, temperature, and vibration throughout. Proprioception is intact. Reflexes are symmetrical throughout. Patient is unable to maintain left ankle dorsiflexion with heel walking.

3. Based on the history and clinical exam above, you suspect peroneal neuropathy. Which of the following would most likely confirm this diagnosis?

- A. Magnetic resonance imaging (MRI) of the lumbar spine.
- B. Electromyography (EMG) and nerve conduction studies.
- C. MRI of the knee with contrast.

DOI: <https://doi.org/10.3357/AMHP.4974.2018>

ANSWER/DISCUSSION

3. B. EMG and nerve conduction studies are most helpful for confirming a diagnosis of peroneal neuropathy and localizing the lesion.⁶ MRI of the lumbar spine can help to assess for radiculopathy in this patient with history of back pain. However, it does not assess for peroneal neuropathy. An MRI of the knee region with contrast may identify an abnormal-appearing peroneal nerve or other nearby pathology such as a compressing mass affecting the peroneal nerve.⁶ However, it can appear normal in patients with peroneal neuropathy and will not confirm the dysfunction of the peroneal nerve.

EMG and nerve conduction findings are consistent with a chronic left axonal peroneal neuropathy with no evidence of active denervation. Based on evidence of reinnervation in the tibialis anterior, reinnervation in the peroneus longus, and normal EMG of the short head of the biceps, the original site of injury is distal to the short head of the biceps, but proximal to the origin of the tibialis anterior (at the knee). There is no evidence to suggest a left L5 radiculopathy or underlying polyneuropathy.

4. What laboratory studies can be considered for further evaluation?

- A. B12/folate.
- B. Lyme titer.
- C. Rapid plasma reagin/Venereal Disease Research Laboratory tests.
- D. Erythrocyte sedimentation rate.
- E. All of the above.

ANSWER/DISCUSSION

4. E. The above testing can assess for other causes of peripheral neuropathy and may be required by the reviewing aviation medical authority. That said, in a patient with isolated foot drop and no other signs or symptoms of neuropathy, the lab testing may not be required.^{6,8}

5. Which of the following is the best course of management of this patient's condition?

- A. Ankle foot orthosis.
- B. Surgical exploration.
- C. Surgical treatment with tendon transfers.
- D. Avoiding compression of the injured nerve.

ANSWER/DISCUSSION

5. D. All of the above are potential management or treatment options for a patient with foot drop, but not necessarily for all patients.⁶ For this patient with residual ability to dorsiflex at the ankle and intact sensation, avoiding additional insult to the patient's peroneal nerve is most important. Ankle foot orthosis and surgical tendon transfer can be considered for patients with more severe foot drop. In cases of acute presentation where the cause of the peroneal neuropathy is not known (including normal-appearing MRI), surgical exploration can be considered. Especially in acute cases, surgical exploration and correction of the underlying cause such as fibular tunnel syndrome or mass may be curative and prevent progression of disability.⁵

6. What is the aeromedical disposition of this patient?

- A. Return to full flight duties.
- B. Permanent restriction from flight duty.

ANSWER/DISCUSSION

6. A. The U.S. Army Aeromedical Policy Letters require clear understanding of the etiology, prognosis, recovery (if applicable), and functional effects of the peripheral neuropathy. Applicable consultations (neurology) and testing (EMG/nerve conduction velocity, Lyme serology, Venereal Disease Research Laboratory test, B12, folic acid, erythrocyte sedimentation rate, etc., as applicable) should be submitted with the waiver. In regard to function, the pilot must be able to manage the aircraft (including rudder and brake pedals) and egress from the aircraft.⁸ The management of the aircraft (both fixed and rotary wing) within the cockpit primarily requires full strength plantar flexion and little dorsiflexion when manipulating the pedals. In cases of foot drop, plantar flexion is preserved (as opposed to "flailed foot"⁶). Regarding egress, this patient has sufficient dorsiflexion strength to perform activities such as running and should be able to egress from the aircraft in an emergency.

The current U.S. Navy Aeromedical Reference and Waiver Guide⁴ and the Federal Aviation Administration's Guide for Aviation Medical Examiners² have similar requirements for waiver application as above. As of June 2017, the U.S. Air Force does not have published guidance specifically on peripheral neuropathies.⁷

A waiver was submitted to the U.S. Army Aeromedical Activity and approved. The patient was counseled to avoid compression of the lateral knee region and continues to serve as a military C-12 pilot.

Patterson A, Rosenthal J. You're the flight surgeon: foot drop. *Aerosp Med Hum Perform.* 2018; 89(2):151–153.

ACKNOWLEDGMENTS

Thank you to Dr. Richard McKibben and Dr. Niel Johnson for reviewing the article and providing valuable insight. The views expressed in this article are those of the authors and do not necessarily reflect the official policy or position of the U.S. Army Medical Department, the Department of the Army, the Department of Defense, or the U.S. Government.

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