



The Early Detection and Management of Diabetic Neuropathy

Sudomotor testing helps evaluate the autonomic nervous system.

BY KEVIN C. MCDONALD, DPM

What Is PN?

Peripheral neuropathy (PN) is a serious disease that affects approximately 20 million people in the United States. PN usually affects the foot first and foremost. A list of common causes of peripheral neuropathy includes hereditary diseases, toxins, infections, cancer, side effects from medications, vitamin deficiencies, malnutrition, connective tissue disorders, and many other metabolic

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disorders, particularly diabetes mellitus.¹

The peripheral nervous system consists of two parts—a) the *somatic* system, which includes the motor and sensory neurons and b) the *autonomic* system, which is comprised of the parasympathetic and sympathetic nervous systems. The two main types of PN are a) *De-myelinating neuropathy*, in which the coverings of the nerves degenerate and b) *Axonal neuropathy*, in which the far ends of the axons deteriorate first followed by the decline of the rest of the axon and eventually the cell body. Axonal neuropathy is by far the most common form of PN and includes the diagnosis of *diabetic neuropathy*, and is the focus of this article.

One of the keys to the diagnosis of axonal PN is that the longest and the thinnest nerves tend to be affected first. The longest chains of nerves occur in the toes and the feet. Therefore, PN is typically first manifested in the toes and then the feet (and then the hands). Motor nerves are thicker and have thicker coatings than sensory nerves, and both motor and sensory nerves are much thicker than autonomic nerves. Thus, motor nerves are typically the last to dysfunction in PN while autonomic nerve dysfunction is the pre-

cursor to the signs and symptoms of somatic nervous system dysfunction.

Diagnosis of PN

The diagnosis of PN is somewhat vague, historically. Patients are typically diagnosed with PN via a) complaints of numbness, tingling, burning or a loss of feeling and b) a physical examination which includes abnormal sensory testing of light touch, vibration, 2-point discrimination, hot versus cold, and the use of a monofilament wire against different surface points of the toes and sole. Motor testing of the reflexes, muscle strength, and joint range of motion can also be helpful in diagnosing PN. There is a lack of quantification in the clinical diagnosis of PN.

Early Detection of PN via Sudomotor Testing

An accurate, sensitive, and quantifiable measure of autonomic nerve disease would be very helpful in the early diagnosis of PN, especially since the best time to treat PN is early, before permanent somatic nerve damage has occurred. The next section will detail a method of the early detection of *autonomic neuropathy* (i.e., early PN) in the feet.

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New Concepts and Studies

“New Concepts” is a forum for the presentation of (1) new technologies and products and (2) new studies involving existing products. Readers should be aware that Podiatry Management does not specifically endorse any of the technologies, concepts, or products being discussed.

THE DIABETIC FOOT



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The “TM Flow” medical testing device² measures the following: a) Blood pressure, b) Ankle brachial indices for the left and right side, c) Arterial stiffness, d) Autonomic fitness markers, and e) Sudomotor nerve function of the feet. Sudomotor nerve testing is a test of the long thin autonomic nerves to the eccrine glands of the soles of the feet. Sudomotor testing of the soles includes measurement of nitric oxide released as a marker of micro-circulation and a measurement of sweat response to stimuli as a marker of C Fiber nerve decreased density and/or function.

The technology described above has been approved by the FDA and provides data recommended to be collected by the American Diabetes Association. These tests are often indicated for people with a) diabetes or “pre-diabetes”, b) complaints of numbness, tingling, burning, coldness, leg cramps, leg fatigue, or a loss of feeling in the feet, and c) an age of over fifty who are overweight, have hypertension, and/or smoke cigarettes.

Treatment of PN

The treatment of PN includes the following:

- 1) Tough Love—Overweight, diabetic patients who

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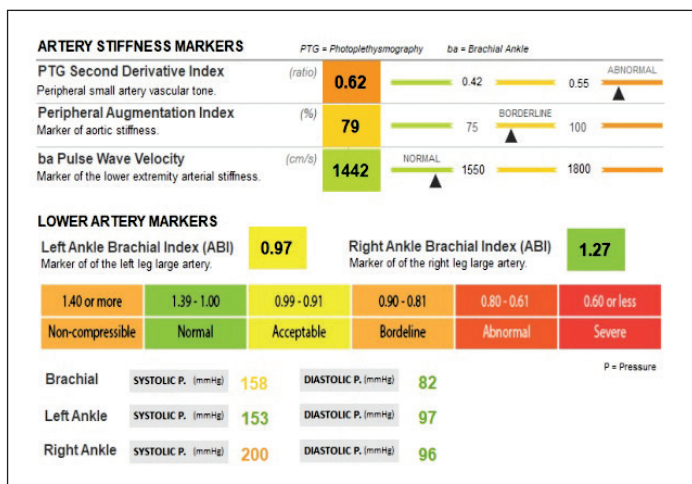


Figure 2: Arterial Stiffness Markers and Ankle Brachial Indices—the TM Flow device calculates the ankle/brachial indices using the blood pressures of the upper and lower extremities. In addition, the test can measure the stiffness of the arteries indicating possible lack of compressibility of the lower extremity arteries which can affect the ABI results. This patient’s test results reveal acceptable ABI ratios, but the abnormal PTG Index is a marker for endothelial damage which correlates with the development of atherosclerosis. Use CPT Code 93922 to bill for this test.

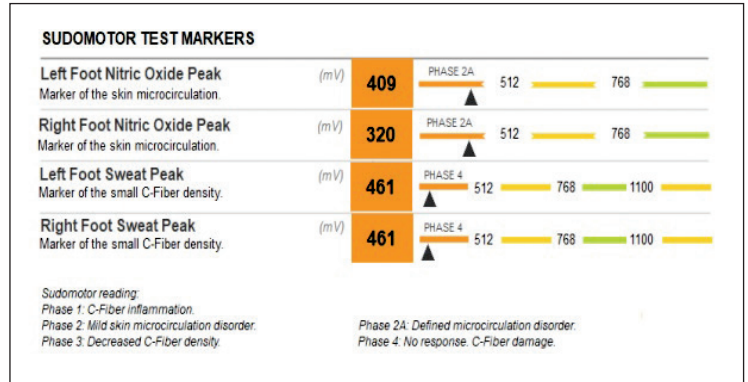


Figure 1: Sudomotor Testing—this test measures the skin’s reaction to a stimulus giving indications for impairment of micro-circulation and the decreased density and function of the autonomic nerves on the soles of the feet. This patient’s test results indicate peripheral neuropathy and impaired micro-circulation. This test (CPT 95923) is currently considered “investigational” by many insurance companies and thus “non-covered” in many cases.

drink and smoke and don’t keep their blood sugar under control should be told something like: “If you want the numbness in your feet to go away and you want to be able to successfully complete intimate physical relations, and you want to see your grandchildren graduate from high school ... YOU NEED to quit drinking and quit smoking and lose 100 pounds and get your HgA1C to less than 6.0.” It’s in your job description to say something like that to them in a heartfelt manner.

2) Exercise—A prescribed Exercise Program a) gets the patient involved in their treatment, b) leads to the release of endorphins which is always a good thing, c) helps with weight loss and blood sugar control which are often indicated, and d) increases the blood flow to the lower extremities leading to improved nerve health.

3) Diet—You are what you eat. A diet featuring lots of vegetables, fruits, and lean proteins will optimize nerve health. Processed, salted, and “fast” foods tend to increase inflammation and should be avoided by people with PN.

4) Life Style Modifications—Proper sleep and abstinence from smoking and drinking alcohol are important factors in decreasing the symptoms and optimizing the health of individuals with PN.

5) Nutritional supplements may be useful as part of the wellness program for PN. More research is required to prove the effectiveness of the various vitamins and medical foods in relieving the symptoms of PN. Purity Standards and an awareness of potential side effects must be also considered.

6) Oral Medications—The anticonvulsant drug pregabalin (Lyrica) and the selective serotonin and norepinephrine re-uptake inhibitor duloxetine (Cymbalta) have been approved by the FDA as treatments for painful diabetic neuropathy. Other first-line medicines for PN include tricyclic antidepressants such as amitriptyline and nortriptyline and the anti-seizure drug gabapentin (Neurontin). Side-effects should be

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considered and watched for with these medicines, particularly with elderly patients.

7) Topical Medications—Topical anesthetics such as lidocaine may be used for painful peripheral neuropathy. The use of a chemical found in chili peppers

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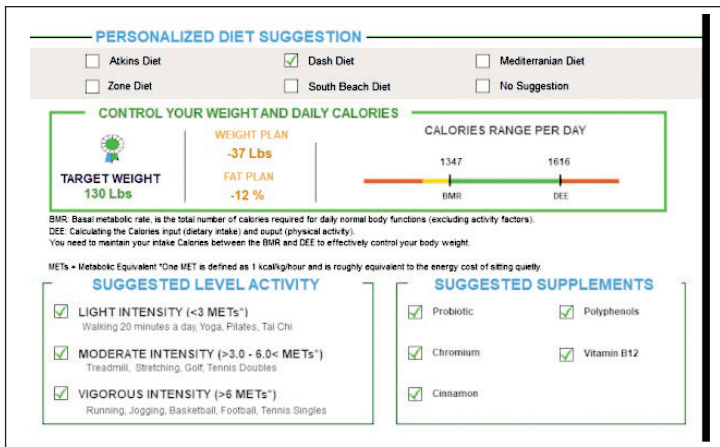


Figure 3: Wellness Program—the program for the TM Flow machine analyzes the results of the tests and the patient’s weight and age to recommend diet, exercise, and dietary supplements which may be helpful to the patient.

(capsaicin) may be helpful for people with painful PN if applied at least three times per day. Compounding pharmacies often tout the benefit of using multiple medications such as phenytoin, baclofen, clonidine, and ketamine in a cream to be applied several times a day. Further study is needed to determine the most effective and cost-efficient combination and dosages of these medicines.

8) The use of light therapy (e.g., Laser Therapy, Anodyne) whereby devices are used to increase the circulation to the skin may be useful in the treatment of painful PN. However, further study is needed and sitting out in the sunshine might give a similar effect. Peripheral nerve stimulation is another avenue to explore if more traditional methods do not relieve the pain of neuropathy.

9) Massage and acupuncture are often viable options for people with PN if done with their doctor’s knowledge and consent and performed in a safe manner.

Summary

1) Peripheral neuropathy is a common and important disease with possible profound effects on the feet.

2) Podiatrists should have a plan for the diagnosis and treatment of peripheral neuropathy. This plan should include patient education initiatives regarding the importance of a) tight blood sugar control, b) smoking cessation and limited alcohol use, c) a healthy diet, and d) a non-sedentary lifestyle with quality sleep.

3) The autonomic nervous system is an under-appreciated bodily function and is usually the first nervous system to be affected by PN. The earlier PN is identified and managed, the better.

4) Sudomotor testing via the measurement of the response to stimuli of the autonomic nerves on the soles of the feet is a sensitive and accurate early indicator of peripheral neuropathy. Sudomotor testing has advantages over epidermal nerve biopsies that include a) no injections, b) no wounds, c) immediate test results, d) quantitative measurements of micro-circulation and C fiber density, e) testing the feet rather than the lower legs, and f) costing less than half of the total cost of the skin nerve biopsies. **PM**

Disclosure: Kevin C. McDonald, DPM has no financial relationship with LD Technologies or any other conflict of interest.

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