

Physical Therapy and Peripheral Neuropathy

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Objectives

- Brief review definition, causes, incidence, risks factors, and pathophysiology of peripheral neuropathy
- Survey interventions provided by physical therapists and efficacy of each
- Overview of typical exercises provided
- Exercise demonstration

Definition

- Peripheral nervous system brings information to and from the brain and spinal cord to the rest of the body
- Peripheral neuropathy (PN) occurs when damage occurs at one (mononeuropathy) or multiple (polyneuropathy) nerves

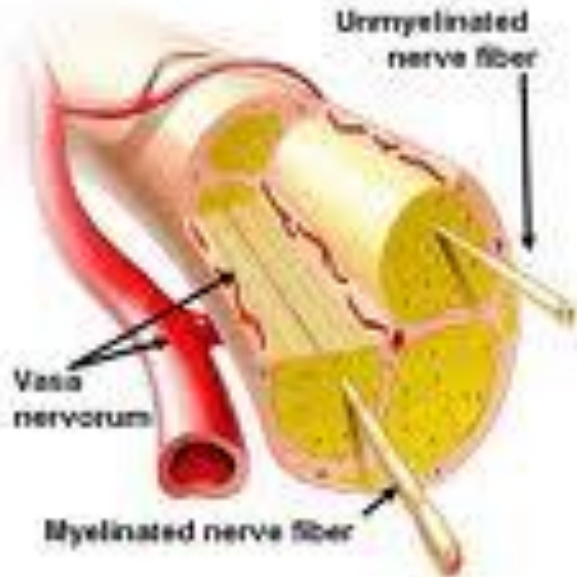
Causes

- Diabetes is most common cause of PN
 - 60-70% of individuals with diabetes have mild to severe forms of PN
- Other causes:
 - Autoimmune disorders
 - Chronic kidney disease
 - HIV and liver infections
 - Low levels of vitamin B12
 - Poor circulation in lower extremities
 - Underactive thyroid gland
 - Trauma
 - Tumor

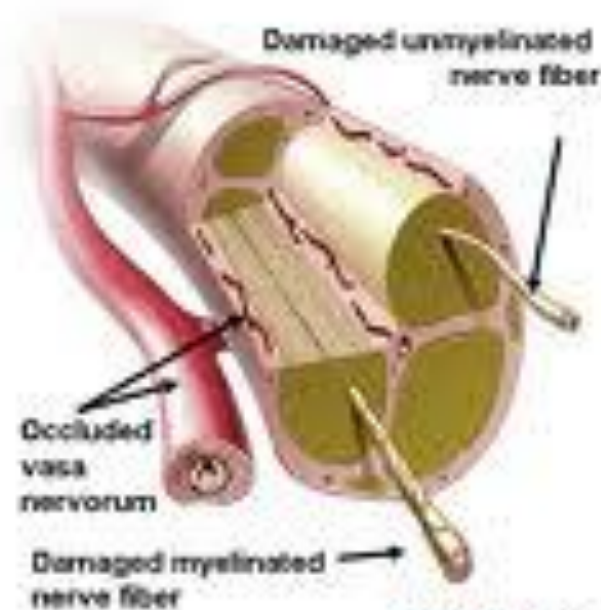
Pathophysiology

Diabetic Peripheral Neuropathy

Healthy Nerves and Blood Vessels



Nerves and Blood Vessels Damaged by DPN



Symptoms

- Peripheral motor neuropathy:
 - Weakness
 - Cramping and fasciculation
 - Muscle loss
 - Bone degeneration
 - Loss of ankle reflexes
 - Changes in skin, hair, and nails

Symptoms

- Peripheral sensory neuropathy:
 - Damage to large, myelinated nerves results in impaired sense of
 - Vibration
 - Light touch discrimination
 - Limb position
 - Damage to small myelinated nerves result in impaired sense of
 - Temperature
 - Pain
 - Hypo or hyper sensitivity

Symptoms

- Peripheral autonomic neuropathy:
 - Diverse manifestation includes
 - Impaired breathing
 - GI dysfunction
 - Difficulty swallowing
 - Inability to sweat
 - Loss of bowel and/or bladder control
 - Loss of blood pressure control
 - Mask angina

Functional Mobility

- Impaired postural stability
 - Greater increase in postural sway seen with more difficult tasks
 - Mechanism is combination of impaired sensation and proprioception
- Impaired gait
 - Gait tends to be more conservative
 - Decreased speed and stride length
 - Greater time spent in double support
 - Reaction time delayed
- In individuals with Type 2 DM, PN, BMI >30 kg/m² and decreased muscle strength were associated with a reduction in daily walking activity

Incidence

- In a 2004 study of 795 community dwelling individuals:
 - PN present in 26% between 65 and 74 years of age
 - PN present in 54% age >85
 - 40% with known cause
 - Risk factors:
 - Increasing age
 - Income less than \$15,000
 - History of military service
 - High BMI
 - Diabetes mellitus (DM)
 - Vitamin B12 deficiency
 - RA
 - Absence of high blood pressure

Incidence

- A 2011 Swedish based study in a population of patients with Type 2 diabetes mellitus (DM):
 - 43% peripheral autonomic neuropathy (PAN)
 - 15-28% peripheral sensory neuropathy (PSN)
 - 15% peripheral motor neuropathy (PMN)
 - Total of 67% experiencing PN
- Nather et al found longer duration since onset of DM is associated with higher prevalence of PN

What can physical therapy do?!?!



Examination/Evaluation

- Thorough history taking
- Observation of skin color, integrity, temperature
 - Presence of pressure points or ulceration?
- Strength testing
- ROM/flexibility testing
- Neurological testing
 - Reflexes
 - Sensation
 - Proprioception
- Balance/coordination
- Foot wear assessment

Sensation Testing

- Light touch discrimination
- Pin-Prick Testing
- Semmes-Weinstein Monofilament Testing
 - Inability to sense pressure from a 5.07 monofilament (10 grams of force) equals loss of protective sensation in foot
- Temperature testing
- Proprioception (joint position sense)
- Tuning fork

Intervention

- Aerobic conditioning
- Progressive flexibility/stretching exercises
- Progressive strengthening exercises
- Balance/coordination
- Gait training
- Alternative :
 - Monochromatic infrared energy
 - Vibrating insoles
 - Tai Chi

Aerobic conditioning

- In 2006, a study investigated the effects of a brisk walking program in diabetic patients without signs and symptoms of PN.
 - Improved nerve conduction velocity
 - No increase in vibration perception threshold
 - Decreased incidence of motor and sensory peripheral neuropathy
 - Motor: treatment = 0% and control = 17%
 - Sensory: treatment = 6.45% and control = 29.8%

Flexibility

- Assessment from trunk to feet
- Goal is to normalize muscle length to allow for normal mechanics with movement

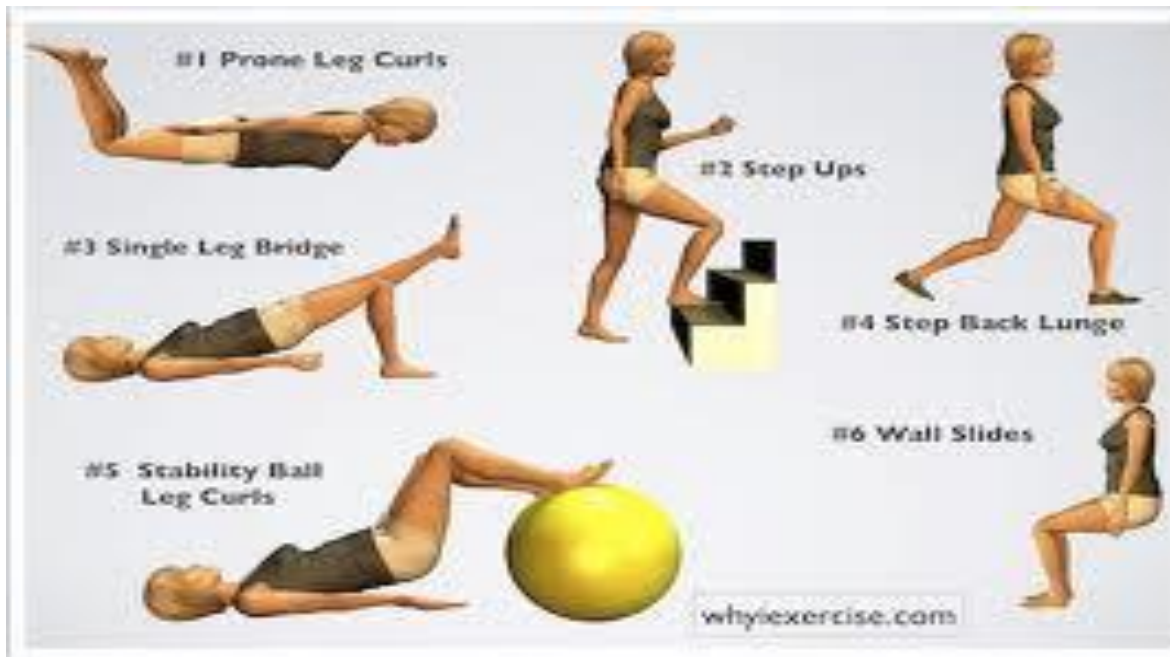


Balance and Strengthening

- In 2001, Richardson et al showed strengthening of the lower extremities improved performance on clinical measures of balance.
- Kruse et al found no increase in incidence of foot ulceration following an exercise program consisting of leg strengthening, balance exercises, and a graduated, self-monitored walking program.
 - Moderate increase in weight-bearing activity
- A follow up to this study in 2010 did not find any significant differences in balance, lower extremity strength, or fall rate.
- Two studies by Van Schie et al found improvement in balance and a trend towards increased lower extremity strength

Strengthening Exercises

- Initial focus is on core, hip, knee, and ankle strengthening
- Progress into functional activities



Monochromatic infrared energy (MIRE)

- Conflicting results in the literature
- Leonard et al (2004) showed MIRE to improve sensation, decrease pain, and improve balance in subjects with diabetic PN
- Poor methodological quality (small sample size, control and active interventions on same subject, no valid balance outcome measure, no ITT analysis, and statistical analysis not appropriate for data obtained)

Monochromatic infrared energy (MIRE)

- Lavery et al showed no improvement when compared to sham therapy
- Large placebo effect noted
- Higher quality study
- Further investigation needed

Vibrating Insoles and Tai Chi

- Utilization of vibrating insoles improved postural sway in quiet standing
 - This is a pilot study and outcome measures not applicable to functional activities
 - Further investigation needed
- A long term (24 wk) Tai Chi program improved functional gait, strength, and plantar sensation in individuals with PN

Balance Exercises



Balance Exercises



Questions?!?!



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