

NEUROPATHIC PAIN EFFECTS PHYSICAL FUNCTION

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Introduction

Chronic diffuse polyneuropathy, more commonly known as peripheral neuropathy (PN), affects approximately 20 million Americans (108th Congress, 2005). PN is marked by chronic deterioration to peripheral nerves that leads to both positive (i.e., painful) and negative (i.e., numbness) symptoms (Boulton et al. 2004).

As little to no lower-extremity strength declines are observed, movement disorders secondary to PN are believed to arise primarily as a result of reduced somatosensory feedback. Although painful symptoms occur in over one quarter of cases, this symptom has been overlooked as a possible factor leading to reduced physical function. The purpose of this experiment was to determine the relationship between foot pain and various measures of physical function in the PN population.

Method

Individuals with physician-diagnosed PN were recruited from the community. Included participants underwent assessments of foot pain, plantar pressure sensitivity, and physical function.

Self-reported foot pain (PAIN) was recorded on a Visual Analog Scale for pain. The scale ranged from 0 - 10, with 10 being the worst possible pain. Plantar pressure sensitivity (PPS) was assessed at five weight-bearing sites on the right foot sole with a 5.07 gauge monofilament. The number of sites with intact sensation was totaled to produce a PPS score ranging from 0-5.

A battery of tests was then completed to assess several components of physical function. Locomotion-based physical function was evaluated by the distance of a 6-minute walk (6MW) test and the duration of a Timed Up-and-Go (TUG) test. For the 6MW, participants were instructed to walk as far as possible around two cones placed 30 meters apart down a well lit hallway. Distance covered (m) was recorded. For the TUG, participants sat with their back against a chair and feet on the floor with a cone three meters in front of the chair. The time (sec) taken to stand up, walk around the cone, and sat back down in the chair was recorded.

Eyes-open and eyes-closed standing balance was assessed by the average velocity (VEL, cm/s) and the area of an ellipse enclosing 95% (AREA, cm²) of the body center of pressure during quiet stance. The average of two, 30sec trials was recorded.

Isokinetic knee joint strength was examined using a Biodex dynamometer (Biodex Medical, Shirley, NY) at 60 deg/sec. Both knee extensor (KE, Nm) and flexor peak torque (KF, Nm) were computed from five maximal effort trials. Peak torque of the best three trials was averaged and used for analysis.

Pearson product correlations (R) were used to examine the relationships between PN symptoms (PAIN, PPS) and the aforementioned physical performance outcomes (6MW, TUG, VEL, AREA, KE, KF). Significance was set to $p < .05$

Results

Participants (20 men, 22 women, mean \pm SE age = 70.8 \pm 1.4 yrs, height = 151.6 \pm 1.6 cm, body mass=79.4 \pm 3.3 kg) had been diagnosed with PN for 6.4 \pm 0.7 years.

PAIN was significantly correlated to performance in both locomotion-based measures of physical function. Specifically, those with increased PAIN tended to perform worse in both the 6MW and TUG tests (Table 1). Conversely, the degree of sensory loss (PPS) was not correlated to performance in either of these measures.

Both PAIN and PPS accounted for a significant amount of variance in selected measures of standing balance performance. Increased PAIN was related to increased eyes-closed AREA and to a lesser extent, eyes-open VEL. Decreased PPS was related only to increased eyes-closed AREA. Neither PAIN nor PPS was related to either measure of leg strength.

Table 1 – Sensory and Pain Correlations (Pearson) on Physical Performance Tests

			Eyes-Open		Eyes-Closed		Leg Strength	
	6MW	TUG	VEL	AREA	VEL	AREA	KE	KF
PAIN	-.46*	.41*	.13	.09	.31	.13*	-.21	-.19
PPS	-.04	-.002	-.32	-.35*	-.32	-.32*	-.28	-.23

Note: * $p < .05$

Conclusion

The primary symptoms of PN, namely foot pain and numbness (PPS), are predictive of physical function. While PPS is associated with reduced standing balance, pain more closely predicts common measures of locomotion-based physical function. Future studies should thus consider self-reported foot pain as a critical factor influencing physical function in this population.

References

108th US Congress, Report. (2005). <http://thomas.loc.gov>.
Boulton A.J., et al (2004). *Diabetes Care*, 27, 1458-86.

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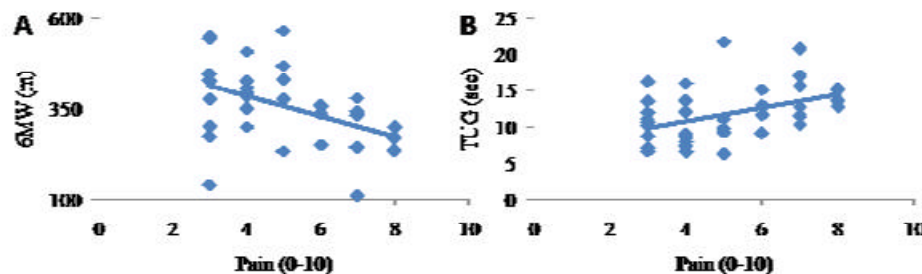


Figure 1. Scatter-plots illustrating the relationship between self-reported foot pain and selected measures of physical function. Linear regression lines are indicated with the solid lines in the scatter-plots.