Neurological Symptoms In Patients With Cancer: An Assessment Toolbox

Neurological symptoms in patients with cancer may stem from three main sources: tumors or malignant cells that develop in the brain or spinal cord, paraneoplastic syndromes which are characterized by cancer-fighting agents of the immune system attacking nerve or muscle cells, and neurotoxic chemotherapy which can cause *chemotherapy induced peripheral neuropathy* (CIPN) and mild cognitive impairment (MCI)).1,2 For the purpose of this assignment, below is a list of tests and measures that may be used in the outpatient physical therapy setting to assess CIPN in cancer patients undergoing chemotherapy. Special attention should be paid to patients receiving certain chemotherapeutic agents that are most often associated with neurological symptoms like CIPN and MCI; these agents include: platinum compounds, taxanes, vinca alkaloids, thalidomide, and bortezomib.3

**Things To Keep In Mind When Assessing CIPN:**

* Baseline neurological assessment can’t be overemphasized – very important with cancer patients4
* Lack of consensus exists regarding which assessment measures are best; often tests and measures used in this population are validated in the diabetic population3
* Although may not be as feasible in every day clinic setting, nerve conduction studies are a valid measure5
* When looking at sensory and motor function in CIPN 🡪 test distal loss to proximal progression4
* Know which medications affect large (cisplatin) versus small sensory (alkaloids, taxanes) nerve fibers4
* Signs and symptoms of CIPN can occur DURING and AFTER treatment 4
* Many of the tests listed below should not be used alone5
* Don’t forget to look at autonomic function; assess bowel sounds, orthostatic blood pressure, and pulse variation with Valsalva maneuver(especially with alkaloids)4

“CLINICAL RULE & CORE SET”5

Reflexes + Vibration + Position Sense

Absence of 2 or 3 🡪 strongly suggests peripheral neuropathy

Absence of 1 or none 🡪 strongly suggests the absence of peripheral neuropathy

**A. Body Structure and Function:**

Considerassessing sensation (large and small fibers), reflexes, neuropathic pain, hand dexterity, balance, gait, and autonomic function.4

1.**Total Neuropathy Score (TNS) & Modified TNS (mTNS)**: A composite score (between 0 – 32) is determined from the combination of subjective sensory symptoms and their effect on daily activities, nerve conduction studies of the sural and peroneal nerves, deep tendon reflexes, manual muscle testing of distal muscles, and quantitative sensory tests (sharp, dull and vibratory discrimination).6 Results from this assessment are comprehensive and useful to detect and quantify CIPN; however, this test may be time consuming.6 A modified version is available (mTNS) that excludes nerve conduction testing and the use of specialized instruments for vibratory sensation testing which may be a better option for clinical use.7

2. **Tuning Fork**: A 128-HZ tuning fork is the most commonly used tool to test quantitative vibratory thresholds (large sensory fibers) and is capable of detecting peripheral neuropathy.8 The method consists of striking the tuning fork maximally, holding it to the patient’s skin (starting at “(1) dorsal head of the first metatarsal joint and (2) distal interphalangeal joint on the second or fifth digit”), and counting how long the patient feels the vibratory sensation.8 Researchers agree that patient report of absence of sensation is abnormal; yet, a uniform criterion to identify diminished sensation has not been determined.8 Lai et al use the patient’s threshold compared against the examiner’s to determine impairment. If vibratory sensation is felt for > 5 secs more by the examiner compared to the patient (in the corresponding joint), then sensory impairment for the patient is noted.8 A different criterion suggesting sensory impairment includes: inability to detect vibration for at least 10 seconds.5 If deficits are noted distally, progress to proximal areas (malleolus and knee; wrist and elbow).4

3. **Semmes Weinstein Monofilaments Test (SWMT)**: These are calibrated nylon monofilaments that “generate a reproducible buckling stress.”9 Often come in full sets of 20 (values ranging from 1.65 to 6.65) which enable the tester to detect small differences in touch thresholds felt by the patient (small sensory fibers).9 Typically, the 5.07 monofilament is used and considered the best indicator of loss of protective sensation.9,10 The tester applies the filament to 10 different sites on the plantar surface of the foot while the patient closes their eyes; if less than seven are detected (buckling of filament) by the patient, the test is positive for protective sensory loss.10 SWMT is typically used with the diabetic population to identify the risk of foot problems;10,11 however, are reliable, effective and useful tools to identifying CIPN. These are easy to use, inexpensive and portable.9 Important locations to test plantar side of foot and palmar side of hands.11 When patients have severe neuropathy, more proximal areas should be assessed.11

4. **Position Sense**: Testing position sense provides information about large sensory fiber functioning.4 Therapist grasps patient’s great toe on medial and lateral surfaces and moves it up and down with the patient s eye’s open.5 The patient is asked to close their eyes, the therapist performs 10 smooth, small amplitude random movements (moving 1cm/sec) asking the patient if the toe is up or down position after each movement.5 Score of fewer than 8 correct responses is considered impairment.5 If patient is impaired at the great toe, assess ankle, then knee position. Sensory deficits in CIPN progress distal to proximal.4 Similarly, assess position sense of finger, to wrist, to elbow.4

5. **Reflexes:** Assess Achilles’ reflex by striking the tendon itself after asking the patient to gently plantar flex their foot (a “facilitation” technique).5 Research has demonstrated that adding the plantarflexion to this test increases reliability in the older population.5 Additionally, “facilitation” may be performed by having the patient clasp their hands in front of their chest and try to pull them apart just before the therapists strikes the tendon.5 Patellar, brachioradialis and biceps reflex should also be part of assessment for CIPN.4 Hyporefelxia and areflexia may suggest CIPN when this test is combined with other significant findings.3

6. **Numerical Pain Rating Scale (NPRS)**: Patients are asked to verbally select the value that is most in line with the pain intensity they have experienced in the past 24 hours on 11-point scale from 0-10 in (0 = no pain; 10 = the most intense pain imaginable).12 This test is quick to administer and is often used with patients with chronic pain and CIPN. Minimal Clinically Important Difference (MCID) for this population is considered a 1.7 points or a reduction of 27.9%.12 Assessing pain in patients with CIPN is important; a subset of patients do experience neuropathic pain that can limit functional ability.3

7. **Manual Muscle Testing (MMT)**: Although sensory impairments often precede motor function loss, weakness is a symptom associated with CIPN.3 Patients with CIPN often demonstrate weakness bilaterally and distally; therefore, it is important to look for distal versus proximal weakness and asymmetries.4 For example, compare dorsiflexion strength versus hip flexor strength and hand grasp compared to deltoid strength.4

8. **Romberg Test**: This test was originally designed to assess static standing balance in patients with neuropathy and associates sensory dysfunction. The therapist has the patient stand with their feet close together, but not touching. Authors suggest that patient perform with shoes off and arms crossed. Patient keeps eyes open for 10 seconds and then closes them. A positive is noted if the patient is unable to maintain the position with closed eyes for 30 seconds.13

9. **Fullerton Advanced Balance Scale (FABS)**: This assessment includes a battery of 10 tasks that challenge visual, vestibular and somatosensory system. Scores range from 0-40 points, each item is scored on a 5 point ordinal scale, and a higher score being better. The FABS is frequently used with breast cancer patients after chemotherapy treatment to assess falls risk. Although this test possesses excellent psychometric properties, it is fairly new, the data is limited and it has only been used in the older population.14

Available at: <http://hhd.fullerton.edu/csa/documents/FABScaleScoringFormwithCut-OffValues.pdf>

10. **Dynamic Gait Index (DGI):** DGI was developed to assess an individual’s ability to walk while performing other tasks or when external demands are applied that require the individual to modify their balance accordingly.15,16 DGI is often used to determine falls risk in patients with diabetic peripheral neuropathy.15 The test consists of 8 items scored on a 4 point scales with a maximum score of 24.16  Minimal Detectable Change is not determined for CIPN population; however, is 2.9 for community dwelling elderly.16 In addition to assessing gait as a falls risk measure, Armstrong et al suggests monitoring gait for wide-based, steppage pattern or signs of pain and balance deficits when working with patients receiving chemotherapy.4

Available at: [www.ptnow.org/asset.axd?id=0b87b0e0-5e0d-48c6-9641-e7a340a473a7&t=635225416434770000](http://www.ptnow.org/asset.axd?id=0b87b0e0-5e0d-48c6-9641-e7a340a473a7&t=635225416434770000)

11. **Subjective Report:** A comprehensive subjective report during intake can be just as sensitive as quantitative sensory testing in being able to detect clinically relevant neuropathy in patients with cancer.4

**Additional Body Structure And Function Measures To Consider:**

* *(Sensory Function)*

**Pin-Prick Testing (PPT)**: PPT is a simple, cheap tool commonly used to assess peripheral neuropathy in patients with diabetes;10 PPT is suitable for patients undergoing chemotherapy as well. A pin is applied in a perpendicular fashion to skin from distal to proximal fashion (great toe of each leg to point where normal sensation is felt, same pattern on hand/arm).4 Test is performed with patient’s eyes closed; patient is asked to raise hand when pain is felt.10

**Pain Quality Assessment Scale (PQAS)**: This is a 20-item questionnaire developed to quantify the quality and intensity of neuropathic pain; maximum score of 200.17

* *(Hand Dexterity)*

**Grooved Peg Board Test:** A timed test of a patient’s ability to place pegs into a slottedboard. Fine motor performance is often impaired in CIPN pateints.4

* *(Motor Function)*

**Dynamometry:** Uses a hand held dynamometer to quantify and assess muscular strength.18

Normative values are found here: <http://www.ncbi.nlm.nih.gov/pmc/articles/PMC1014394/>

* *(Balance and Gait)*

**Single Leg Stance (SLS**): Impaired in patients with diabetic peripheral neuropathy and associated with an increased risk for falling.5 Test the patient for a max of 30 seconds on each foot; failure occurs with shift in foot or nonstance foot touches ground.5

**Berg Balance Test:** A 14-item objective measure designed to assess static balance and fall risk in adult populations.19 Each item scored on 4 point scale.19 Falls risk is considered 45 or less out of a maximum score of 56.15

Available at: <http://www.fallpreventiontaskforce.org/pdf/BergBalanceScale.pdf>

**Timed Up And Go (TUG):** Timed test to assess balance and functional mobility.15 Patient stands up from seated position, walks 3 meters, turns around, walks back and sits back down.15

**B. Activity And Participation:**

1. **Functional Assessment of Cancer Therapy** – Taxane (FACT- Taxane): A 43-item health related quality of life questionnaire that combines the previously validated FACT-general (27-items) with a taxane subscale (16-items).20 Areas addressed include: emotional well-being, functional well-being, physical well-being, social/family well-being, a previously validated 11-item neurotoxicity subscale, and 5 additional questions that are specific for side-effects associated with taxane chemotherapy (for example – “quantify how difficult functional tasks have become and how bothersome symptoms are.”).20

Available at: <http://www.facit.org/FACITOrg/Questionnaires>

2. **European Organization for Research and Treatment of Cancer (EORTC) Quality of Life Questionnaire - CIPN:** A 20-item patient report assessment addressing sensory, motor and autonomic function in patients with CIPN and the QOL issues that result from these defictis.21

3. **Short Form 36 Questionnaire (SF-36):** Used to measure aspects of disablement including: physical and mental function and health-related quality of life.22 Demonstrates good psychometric properties when used with patient with peripheral neuropathy. Available at: <http://www.rand.org/health/surveys_tools/mos/mos_core_36item_survey.html>

**Additional Activity and Participation Measures To Consider:**

**World Health Organization Disability Assessment Schedule 2.0**: A 32 item test used to measure disability in 6 major life domains (understanding & communicating, getting around, self-care, getting along with people, household activities and participation in society).23

Available at: <http://www.who.int/classifications/icf/whodasii/en/>

**Fact – G:** Gold standard measure for cancer patients receiving chemotherapy.

Available at: <http://www.facit.org/FACITOrg/Questionnaires>

**Fatigue Severity Scale (FSS):** A 9 item measure that assessing severity fatigue and effect of fatigue on lifestyle and participation in daily activities.24 Commonly used with patients with peripheral neuropathy.

Remember

Chemotherapy-Induced Mild Cognitive Impairment is Also A Neurological Symptom:

Assess fatigue, confusion, attention, memory, ability to focus, processing speed, ability to remember details, learn new skills, and multitask ability (executive function).

Consider: Montreal Cognitive Assessment (MoCA) OR Mini Mental State Examination (MMSE)

References:

1. Stanford Medicine. Neurological Complications of Cancer Available at: <http://cancer.stanford.edu/braincancer/complications.html>. Accessed March 31, 2014

2. National Institute of Neurological Disorder and Stroke. Paraneoplastic Syndromes Information Page. Available at: <http://www.ninds.nih.gov/disorders/paraneoplastic/paraneoplastic.htm>. Accessed 3/2/14

3. Visovsky C, Collins M, Abbott L, Aschenbrenner J, Hart C. Putting evidence into practice: Evidence-based interventions for chemotherapy-induced peripheral neuropathy. *Clin J Oncol Nurs*. 2007;11(6):901-913. doi: 10.1188/07.CJON.901-913.

4. Armstrong T, Almadrones L, Gilbert MR. Chemotherapy-induced peripheral neuropathy. *Oncol Nurs Forum*. 2005;32(2):305-311. doi: 10.1188/05.ONF.305-311.

5. Richardson JK. The clinical identification of peripheral neuropathy among older persons. *Arch Phys Med Rehabil*. 2002;83(11):1553-1558.

6. Cornblath DR, Chaudhry V, Carter K, et al. Total neuropathy score: Validation and reliability study. *Neurology*. 1999;53(8):1660-1664.

7. Smith EM, Cohen JA, Pett MA, Beck SL. The reliability and validity of a modified total neuropathy score-reduced and neuropathic pain severity items when used to measure chemotherapy-induced peripheral neuropathy in patients receiving taxanes and platinums. *Cancer Nurs*. 2010;33(3):173-183. doi: 10.1097/NCC.0b013e3181c989a3; 10.1097/NCC.0b013e3181c989a3.

8. Lai S, Ahmed U, Bollineni A, Lewis R, Ramchandren S. Diagnostic accuracy of qualitative versus quantitative tuning forks: Outcome measure for neuropathy. *J Clin Neuromuscul Dis*. 2014;15(3):96-101. doi: 10.1097/CND.0000000000000019; 10.1097/CND.0000000000000019.

9. Smith EM, Cohen JA, Pett MA, Beck SL. The reliability and validity of a modified total neuropathy score-reduced and neuropathic pain severity items when used to measure chemotherapy-induced peripheral neuropathy in patients receiving taxanes and platinums. *Cancer Nurs*. 2010;33(3):173-183. doi: 10.1097/NCC.0b013e3181c989a3; 10.1097/NCC.0b013e3181c989a3.

10. Nather A, Neo SH, Chionh SB, Liew SC, Sim EY, Chew JL. Assessment of sensory neuropathy in diabetic patients without diabetic foot problems. *J Diabetes Complications*. 2008;22(2):126-131. doi: 10.1016/j.jdiacomp.2006.10.007; 10.1016/j.jdiacomp.2006.10.007.

11. Mueller MJ. Identifying patients with diabetes mellitus who are at risk for lower-extremity complications: Use of semmes-weinstein monofilaments. *Phys Ther*. 1996;76(1):68-71.

12. Rehabilitation Measures Database. Numeric Pain Rating Scale. Rehab Measures. Available at: <http://www.rehabmeasures.org/Lists/RehabMeasures/PrintView.aspx?ID=891>. Updated 2010. Accessed April 1, 2014

13. Rehabilitation Measures Database. Romberg Test. Rehab Measures. Available at: <http://www.rehabmeasures.org/Lists/RehabMeasures/PrintView.aspx?ID=1173> . Updated 2010. Accessed April 1, 2014.

14. Rehabilitation Measures Database. Fullerton Advanced Balance Scale. Rehab Measures. Available at: <http://www.rehabmeasures.org/Lists/RehabMeasures/PrintView.aspx?ID=1056>. Updated 2010. Accessed April 1, 2014.

15. Jernigan SD, Pohl PS, Mahnken JD, Kluding PM. Diagnostic accuracy of fall risk assessment tools in people with diabetic peripheral neuropathy. *Phys Ther*. 2012;92(11):1461-1470. doi: 10.2522/ptj.20120070; 10.2522/ptj.20120070.

16. Rehabilitation Measures Database. Dynamic Gait Index. Rehab Measures. Available at: <http://www.rehabmeasures.org/Lists/RehabMeasures/PrintView.aspx?ID=898>.

Updated 2010. Accessed April 1, 2014

17. Galer BS, Jensen MP. Development and preliminary validation of a pain measure specific to neuropathic pain: The neuropathic pain scale. *Neurology*. 1997;48(2):332-338.

18. Rehabilitation Measures Database. Handheld Dynamometry. Rehab Measures. Available at: <http://www.rehabmeasures.org/Lists/RehabMeasures/PrintView.aspx?ID=1052>. Updated 2010. Accessed April 1, 2014.

19. Rehabilitation Measures Database. Berg Balance Score. Rehab Measures. Available at: <http://www.rehabmeasures.org/Lists/RehabMeasures/PrintView.aspx?ID=888>. Updated 2010. Accessed April 1, 2014.

20. Wampler M. Chemotherapy-induced Peripheral Neuropathy Fact Sheet. <http://www.oncologypt.org/pdfs/fact-sheets/CIPN-Factsheet.pdf>. Updated 9/12/06. Accessed April 1, 2014.

21. 3. Lavoie Smith EM, Barton DL, Qin R, Steen PD, Aaronson NK, Loprinzi CL. Assessing patient-reported peripheral neuropathy: The reliability and validity of the european organization for research and treatment of cancer QLQ-CIPN20 questionnaire. *Qual Life Res*. 2013;22(10):2787-2799. doi: 10.1007/s11136-013-0379-8; 10.1007/s11136-013-0379-8.

22. Ware J. SF 36 Health Survey Update. Available at: <http://www.sf36.org/tools/sf36.shtml>. Accessed April 1, 2014.

23. World Health Organization. WHO Disability Assessment Schedule 2.0 WHODAS 2.0

WHO. Available at: <http://www.who.int/classifications/icf/whodasii/en/>. Accessed April 1, 2014

24. Rehabilitation Measures Database. Fatigue Severity Scale. Rehab Measures. Available at: http://www.rehabmeasures.org/Lists/RehabMeasures/PrintView.aspx?ID=1101. Updated 2010. Accessed April 1, 2014.