Effects of Chemotherapy on Vestibular and Somatosensory Function in Older Breast Cancer Survivors

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PROBLEM & RELEVANCE

Many studies have shown that strength can be improved in older adults using different types of resistance training. Although strength and balance are related, resistance training alone has been shown to have only a modest effect on improving balance. This is likely due to the fact that the ability to maintain balance involves a complex set of processes that require the successful integration of multiple components including several sensory systems that are not typically affected with resistance training. These sensory systems include the visual, vestibular, and somatosensory systems. The visual system provides information about a person’s position and movement through the environment, and identifies objects on the floor to step around or over. The vestibular system, provides information about head movement and the body’s position in space. The somatosensory system monitors the body’s position and contact with other objects using muscle receptors that detect body movement and skin receptors that relay information about touch and vibration. Based on input from these systems, the brain sends signals to muscles that make corrections to maintain balance. The nervous system accesses preprogrammed strategies to simplify movement, like a database for motor memories. The central nervous system works with groups of muscles that respond in a repeatable sequence that had been successful to maintain stability in the past. If any of these systems is impaired, the body’s ability to maintain balance is diminished.

With advancing age, muscle strength and sensory function decrease, contributing to losses of balance and a greater risk for falls. Chemotherapy as a treatment for breast cancer may cause similar cognitive impairments. Chemo brain is a term referring any cognitive dysfunction that cancer survivors may experience following cancer treatment. Although chemo brain is a common term used by survivors, the exact cause of the cognitive changes are not clear, nor is there an understanding of the severity of memory, concentration, or sensory problems that may affect someone after chemotherapy.

DESIGN & METHODS

The Clinical Test of Sensory Integration and Balance (CTSIB) is a standardized test for balance assessment on a static surface. This test has been validated and shown to be an effective test for identifying individuals with mild to severe balance problems. The test provides an assessment of how well an individual can integrate various senses with respect to balance and compensate when one or more of those senses are compromised. Many cancer survivors with cognitive problems still score well on cognitive tests, leaving researchers and doctors confused themselves. We hypothesize that the CTSIB test, when combined with a cognitive assessment, will identifying whether or not chemotherapy is contributing to balance impairment that is related to the expected cognitive dysfunction. CTSIB is an objective test reliant on muscle memory; if cognitive dysfunction is present this should result in a deficit in postural stability. To address the cognitive demands of sensory integration, a Dual Task Assessment will be used by having participants concurrently perform each cognitive task while standing on the balance platform.

Sway and stability index will be assessed using a Balance System SD (BIODEX®; New York, NY, USA) platform. The Clinical Test of Sensory Interaction and Balance (CTSIB) is standardized test for balance assessment on a static surface. The test provides a generalized assessment of how well an individual can integrate various senses with respect to balance and compensate when one or more of those senses are compromised. The CTSIB with consist of four, 30 second tests; Condition 1 – eyes open firm surface (baseline: incorporates visual, vestibular and somatosensory inputs), Condition 2 – eyes closed firm surface (eliminate visual input to evaluate vestibular and somatosensory inputs), Condition 3 – eyes open on a dynamic surface (used to evaluate somatosensory interaction with visual input), Condition 4 – eyes closed on dynamic surface (used to evaluated somatosensory interaction with vestibular input). A participant’s results will either be better, equal to or worse than normal. The higher the sway index score, the more unstable the person was for the condition. Results will be compared to a healthy age-matched Control Group selected from the Center for Physical Activity and Aging.

Participants will be recruited from the KU Wichita Center For Breast Cancer Survivorship, where the author has a joint appointment. The Center has developed a collaborative relationship with the Dept of HPS at WSU to provide assessments of physical ability and exercise coaching for survivors.

The Human Performance Laboratory is located in the Heskett Center and is equipped with research and clinical grade fitness and physiological assessment tools and Directed by the author. Over the past year, eight breast cancer survivors have been assessed (avg age 63 yrs) for bone density, muscular strength, and aerobic capacity. The proposed study will add a balance assessment.

GRA TASK, SUPERVISION, & BENEFITS

The proposed project will incorporate mentorship for a master’s candidates by the PI Dr. Patterson. Mentorship goals will combine hands-on project management at the Human Performance Laboratory, structured didactic learning through appropriate coursework in the Master’s of Exercise Science, and facilitated learning through University of Kansas School of Medicine-Wichita research meetings and community meetings.

The GRA responsibilities will be equipment set up, calibration, assist with data collection, and assist participants with their exercise program. Specifically, the GRA will assess body composition, bone density, balance, stability, muscular strength and endurance, and physical work capacity on all individuals referred by the Center for Breast Cancer Survivorship at KU Med - Wichita. The GRA will gain valuable clinical and research experience. The GRA will be supervised by Dr. Jeremy Patterson, the Director of the Human Performance Laboratory and Associate Professor in HPS and will be expected to use some portion of the collected data as a thesis and present at a national conference. Additionally, the GRA will be expected to complete the American College of Sports Medicine (ACSM) certification exams necessary to become a certified cancer exercise trainer.