

Vestibulotoxicity in Cancer Survivors: Identification and Treatment

Mary Jesse, PT, DHS

Board-Certified Clinical Specialist in Oncologic and Orthopedic Physical Therapy

Summary

The number of cancer survivors in the United States has shown a steady increase in recent years. In 2019, there were an estimated 16.9 million cancer survivors in the United States; this number is expected to increase to 22.2 million by 2030 (31.3% increase).¹ Approximately 39.5% of men and women will be diagnosed with cancer at some point during their lifetimes (based on 2015-2017 data).¹ This is related to two phenomena: 1) improvement in cancer survival rates due to early detection and improvement in cancer treatment, and, 2) the aging population.² The impact of the disease and/or treatment along with an increased life expectancy may have an unwanted result of an increased fall risk.^{3,4,5}

One factor that may affect balance in the oncology population is vestibulotoxicity.^{6,7,8,9} Vestibulotoxicity is imbalance caused by drug-induced damage to the vestibular system. Different drugs/medications have been identified as causes, including chemotherapy agents.^{6,7,9} Specifically, platinum-based chemotherapy agents, like cisplatin are noted to have long-term retention in the cochlea and vestibule component.^{6,7} Since the auditory and vestibular organs of the inner ear share blood, nerve, and fluid sources, both hearing and balance issues could present.^{6,7,9} In a scoping review performed by Prayuenyong⁶, the rate of occurrence of an abnormal vestibular function test after chemotherapy administration ranged from 0 to 50%.⁶ Results may vary by lack of recognition of signs and symptoms, either from underreporting or compensation by vision and proprioception, as well as attributing balance issues to other medications or to medical issues of dehydration, chronic fatigue, and/or anemia.⁶

Ototoxicity

- Ototoxicity is a pharmacological adverse reaction affecting the inner ear or auditory nerve, characterized by cochlear or vestibular dysfunction¹⁰
- Cochlear damage results in hear loss and/or tinnitus
- Vestibular damage results in balance issues or dizziness¹¹

Reason for summary

Cancer survivors experience many side effects of both cancer and treatments that effect their quality of life and daily functional activities. Knowledge of the possibility of the presence of vestibulotoxicity may help the clinician better understand a patient's challenges as well as make more educated recommendations on safety.

Clinical Presentation of Vestibulotoxicity^{6,8}

- Positional vertigo (generally presents bilaterally)
 - Dizziness
 - Unsteadiness
 - Falls
- Symptoms may improve after treatment but generally don't resolve completely.

Patient Population Involved¹⁰

- Vestibulotoxicity can occur with various therapeutic agents including aminoglycoside antibiotics (gentamicin, tobramycin, streptomycin), platinum-based chemotherapeutic agents, loop diuretics, macrolide antibiotics, and antimalarials.¹⁰
- Platinum-based chemotherapeutic agents, such as carboplatin and cisplatin, are alkylating agents. They may be used for most types of cancer, but generally of greatest value in treating slow-growing cancers.

Specific Considerations for Cancer Survivors⁸

- Many times the signs/symptoms of vestibulotoxicity are not identified; they may present less abruptly than positional vertigo and the specific presentation may vary among patients.
- Patients may be able to compensate through vision and proprioception.
- Other non-specific symptoms experienced by the survivor may mask the vestibulotoxicity – deconditioned state, dehydration, nausea and vomiting, chronic fatigue, neuropathy, and anemia.

Identification of Vestibulotoxicity¹²

- Subjective report of symptoms by patient of disequilibrium or unsteadiness; This may not be a reliable indicator as many may attribute there symptoms to inactivity or general malaise and fatigue.
- Vestibular evaluation using clinical and/or laboratory testing.
- Strength, muscle tone, sensation, coordination, balance, and gait assessments should be included to determine compounding factors.
- Comorbidities, such as neuropathy or orthopedic conditions, may need to be considered as well.

Treatment¹²

- Vestibular rehabilitation to promote central nervous system compensation and substitution to promote adaptation, and to facilitate habituation of symptoms.
- Treatment to address other identified issues such as strength, endurance, gait, safety, and balance.

Articles included in review:

1. National Cancer Institute. Cancer statistics. 2020. <https://www.cancer.gov/about-cancer/understanding/statistics>. Accessed November 8, 2021.
2. De Moor JS, Mariotto AB, Parry C, Alfano CM, Padgett L, Kent EE, Forsythe L, Scoppa S, Hachey M, Rowland JH. Cancer survivors in the United States: Prevalence across survivorship trajectory and implications for care. *Cancer Epidemiol Biomarkers Prev.* 2013; 22(4): 561-570.
3. Bird ML, Cheney MJ, Williams, AD. Accidental fall rates in community-dwelling adults compared to cancer survivors during and post-treatment: A systematic review with meta-analysis. *Oncol Nurs Forum.* 2016;43(2): E64-E72.
4. Spoelstra SL, Given BA, Schutte CL, Sikorskii A, You M, Given CW. Do older adults with cancer fall more often? A comparative analysis of falls in those with and without cancer. *Oncol Nurs Forum.* 2013;40(2): E69.
5. Wildes TM, Dua P, Fowler SA, Miller JP, Carpenter CR, Avidan MS, Stark S. Systematic review of falls in older adults with cancer. *J Geriatr Oncol.* 2015;6(1): 70-83.
6. Prayuenyong P, Kasbekar AV, Hall DA, Hennig I, Anand A, Baguley. Imbalance associated with cisplatin chemotherapy in adult cancer survivors: A clinical study. *Otol Neurotol.* 2021;42: e730-e734.
7. Hülse R, Stuck BA, Hörmann K, Rotter N, Nguyen J, Aderhold C, Schell A. Changes in Vestibular Function in Patients With Head-and-Neck Cancer Undergoing Chemoradiation. *Ear Nose Throat J.* 2020 Sep 14; 1-7.
8. Prayuenyong P, Taylor JA, Pearson SE, Gomez R, Patel PM, Hall DA, Kasbekar AV, Baguley. Vestibulotoxicity associated with platinum-based chemotherapy in survivors of cancer: A scoping review. *Frontier Oncol.* 2018;8: Article 363.
9. Ding D, Jiang H, Zhang J, Xu X, Weidong Q, Shi H, Yin S, Salvi R. Cisplatin-induced vestibular hair cell lesion-less damage at high doses. *J Otolology.* 2018;13: 115-121.
10. Ganesan P, Schmiedge J, Manchaiah B, Swapna S, Dhandayutham S, Kothandaraman P. Ototoxicity: A challenge in diagnosis and treatment. *J Audiol Otol.* 2018; 22(2): 59-68.
11. Hülse R, Stuck BA, Hörmann K, Rotter N, Nguyen J, Aderhold C, Schell A. Change in vestibular function in patient with head-and-neck cancer undergoing chemoradiation. *Ear Nose Throat J.* 2020; 1-7.
12. Handelsman JA. Vestibulotoxicity: strategies for clinical diagnosis and rehabilitation. *Int J Aud.* 2018;57: S69-S77.