Chapter 4

Balance and Rehabilitation in Elderly Cancer Patients: A Review

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Abstract

In recent years, advancements in cancer diagnosis and treatment modalities have led to heightened survival rates and extended life expectancy post-cancer treatment. The incidence of cancer increases with age, and during the elderly phase following cancer treatment, individuals often experience additional challenges due to the side effects of treatments, in contrast to healthy aging.

Among elderly individuals undergoing cancer treatment or those who have survived cancer, there is a troublingly elevated prevalence of falls and subsequent mortality compared to their healthy counterparts. Sensory deficits, neuropathy, neuropathy, cachexia, sarcopenia, impaired bone integrity, sleep disturbances, cognitive decline, increased fatigue, dementia, depression and decreased physical activity due to cancer treatment increase balance problems among older cancer survivors. Metastatic conditions and continued corticosteroid and hormone therapies post-cancer are also recognized as contributors to balance issues in cancer survivors.

Early implementation of goal-oriented exercise regimens during cancer treatment is essential to reduce functional deficits and restore impaired function. Assessment and rehabilitation of impaired functioning in elderly cancer survivors is essential for safe aging in the long term.

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INTRODUCTION

The International Agency for Research on Cancer (IARC), a subsidiary of the World Health Organization (WHO), released its latest estimates of the global cancer burden on 15 December 2020. The GLOBOCAN 2020 database, part of the IARC Global Cancer Observatory, is available online and provides estimates of incidence and survival rates for 36 specific cancer types in 185 countries and for all cancer types combined for 2020. In the light of these data, it was reported that the global cancer burden increased to 19.3 million new cases and 10.0 million lives lost in 2020.[1] Despite advancements in treatment, cancer remains one of the leading causes of mortality. It is known that breast cancer is the most common cancer in the world and lung cancer is the deadliest. In men, lung cancer is the most diagnosed cancer and the leading cause of cancer-related deaths. In women, breast cancer is the most diagnosed cancer and the main cause of cancer-related deaths.[3]

Medications administered to cancer patients and their compositions are continuously evolving. A study on this subject revealed that mortality rates due to cancer decreased by 2% among individuals aged 20-49, by 3% among those aged 50-64, and by 5-6% annually among patients aged 65 years and above, with the introduction of new drugs. While the rates of cancer diagnosis have increased, improved survival rates following cancer have underscored the significance of rehabilitation processes for post-cancer quality of life.[2]

The incidence of cancer increases with age, and aging post-cancer presents increased complexities. A review focusing on priority issues in older patients with cancer highlighted the importance of epidemiologic assessment of functioning and disability, as well as evaluating the impact of cancer treatment on falls, disability, participation, survival, quality of care and cost-effectiveness. This study also discussed the effects of cancer treatment on balance and summarized assessment and recovery approaches especially in elderly cancer patients.[3]

METOD

This study was prepared as a literature review by examining a lot of studies on balance-related conditions, evaluations and results during and after treatment in elderly cancer patients and cancer survivors.

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3 "Dünya Kanser İstatistikleri 2020 – Her 5 kişiden biri kanserle karşılaşıyor (World Cancer Statistics 2020 - One in 5 people face cancer)" https://www.drozdogan.com/dunya-kanser-istatistikleri-2020-her-5-kisiden-biri-kanserle-karsilasiyor/

Clinical and research implications

Balance disturbances are frequently observed in cancer patients and usually occur from the early stages of treatment. Data emphasize that balance is impaired and walking speed decreases after the first chemotherapy session.[4]

Effects of cancer treatments on balance

A related study revealed a 26% fall risk among breast cancer survivors aged over 65 and a 22% risk among prostate cancer survivors.[5] A systematic review highlighted gait and balance impairments in breast cancer survivors and suggested interventions to improve these impairments.[6] In the literature, many reasons related to the type and stage of cancer, sensory-cognitive side effects of medications and sensory-cognitive side effects of medications have been reported to cause balance problems in the elderly undergoing and surviving cancer treatment (Table 1).

In cancer patients, factors such as metastatic status, cancer type, hormone therapy, and long-term corticosteroid use increase the risk of falls and post-fall complications.[7-10] Given that falls can lead to severe consequences, including mortality, in patients undergoing cancer treatment, early diagnosis, careful monitoring and patient education are crucial.[7-11]

Neuropathy commonly develops post-chemotherapy and radiotherapy, contributing to lower functional performance in balance-related assessments.[12-15] Sensory deficits, sarcopenia, sleep disturbances, cognitive impairment, dementia, and depression post-cancer treatments increase fall risks.[16] Visual perception deficits due to hormonal treatments, and inner ear structural changes caused by certain drugs are sensory deficits that increase the risk of falls.[17, 18] Studies indicate a higher prevalence and earlier onset of sarcopenia in cancer patients compared to the general population.[11-19] Reduced muscle strength correlates with increased fall risks, while sleep disturbances are more prevalent among cancer patients than in the general population.[20] Elderly individuals undergoing cancer treatment experience sleep problems, aggravated by anxiety and cancer recurrence.[21] Non-pharmacological interventions are recommended to prevent polypharmacy in addressing pain, depression, and fatigue, which aggravated sleep disturbances.[22, 23]

The term "chemo-brain" describes cognitive impairment resulting from cancer treatments and characterized by decreased cognitive capacity, impaired executive functions, attention deficit and decreased processing speed.[24] Factors affecting cognitive decline include cancer stage, chemotherapy

drugs, age and ongoing hormone therapy, and cognitive impairment continues after treatment.[25, 26] In a related study, it was observed that elderly cancer patients with a history of falls exhibited poorer cognitive status.[27] Depression, dementia, decreased functional capacity, inadequate social support and frailty have been identified as factors that increase risk of falls in elderly cancer survivors.[28]

Table 1. Factors That Increase the Risk of Falls by Weakening Balance Functions in Cancer Treatments

Cancer-related conditions	**Side effects of drugs**	**Psychological and cognitive effects of cancer**
Type of cancer Metastatic conditions Chemotherapy Radiotherapy Hormone therapy Long-term use of corticosteroids Pain, Fatigue	Weakening of bone structure Neuropathy Sensory issues Decreased visual acuity Damage to structures inside the ear Sarcopenia	Depression Dementia Perception of reduced social support Cognitive problems Sleep problems

Prepared by the author using the sources indicated (references 7 and 28)

Evaluation of balance function in elderly cancer

Patients' conditions such as advanced age, polypharmacy, and opioid use, which increase the risk of falls in healthy elderly individuals, may not adequately predict the risk of falls in elderly cancer survivors. It has been reported that a distinct process, separate from age-related conditions, negatively impacts balance in cancer survivors.[16]

The Comprehensive Geriatric Assessment is often used to identify general problems in older patients. This assessment involves determining the patient's functional level as well as observing other existing conditions, psychological and financial status, level of social support, medication use, nutritional status, and cognitive function. Basic complications such as pain, fatigue, osteoporosis, and lymphedema, which are commonly seen in cancer patients, can be evaluated with this method.[29] Comprehensive Geriatric Assessment is a teamwork, and physiotherapists are a part of this team.[30]

Falls may not be a primary concern for patients or oncologists, or patients may not associate such events with their cancer treatment. Therefore, inquiring about fall history is imperative for patients or cancer survivors. One study on the subject found that only 48% of individuals who experienced falls during cancer treatment reported these events to their

oncologist. Among the reported cases, one in every 20 elderly individuals had their treatment interrupted by a fall.[31]

One of the initial tests developed in 1986 for assessing fall risk was the Get Up and Walk Test (TUG). This test was later refined and renamed the Timed Up and Go Test (TTUG). These tests comprise timed tasks, with participants scored based on task completion within specified durations. Since the TUG test does not define the time lost in each task, the Extended Get Up and Go Test (ETUG) was developed over time to assess the risk of falls, especially in people with mobility problems.[32]

While balance assessment tests are evolving, standing on one leg and the TUG test remain among the most utilized methods for assessing fall risk in the literature.[31-32] Standing on one leg for less than 30 seconds has been associated with an increased fall risk.[33] In the TUG test, participants are required to walk 3 meters in under 10 seconds. A duration exceeding 14 seconds suggests the need for home adaptations, while durations over 20 seconds indicate a significant balance disorder and the necessity of assistive devices.[34] For patients with high functionality, prioritizing walking speed over the TUG test has been recommended.[35] BESTest (Balance Evaluation Systems Test) and its shortened form, mini BESTest, are among the tests recommended to assess the risk of falls.[36]

Dynamic balance should be maintained in daily life. If patients can maintain their balance while performing tasks such as looking left and right, up and down or performing simple mathematical calculations during balance tests, it indicates that their dynamic balance is good. According to a systematic review, deficits in dual-task tests correlate with an increased risk of falls.[37] These tests can also serve as exercises to enhance balance.

Balance rehabilitation in elderly cancer patients

Optimal muscle strength, adequate bone mineral density, sufficient sensory input, and adequate cerebellar activation are essential for maintaining good balance. The primary strategy in this regard is structured exercise. However, contraindications must be carefully considered, as in any therapeutic intervention. In cancer patients, exercise should be avoided in cases of thrombocytopenia ($<200,000/\mu L$), severe anemia ($Hb<6$), or fever $>38.5°C$. In the presence of leukopenia ($<40,000/\mu L$, high risk of infection), exercise can be undertaken with precautions. Exercise is relatively contraindicated in the presence of chest pain and dyspnea and may be postponed in cases of extreme fatigue or unexplained pain on a given day.

Patients with irregular resting heart rates or blood pressure irregularities should be closely.[38]

Clinical blood values of patients can guide therapists in prescribing appropriate exercise regimens. It has been recommended that patients in poorer condition be encouraged to engage in daily activities, whereas those in fair condition (Hb>8, platelet count>30,000) should undertake moderate aerobic and mild resistance exercises. Patients in better condition (Hb>10, platelet count>50,000) are directed towards progressive resistance exercises.[39]

Exercise can be concentric or eccentric. Studies suggest that eccentric training enhances muscle tissue by increasing protein synthesis and may be beneficial for cachectic patients, who often experience sarcopenia.[40] Eccentric exercises are particularly emphasized due to their low metabolic load, suitable for frail cancer patients.[41] According to a review on exercise interventions for sarcopenic and frail elderly individuals, aerobic endurance and multicomponent exercises over three months have been shown to increase muscle strength.[42]

Bone mineral density is a crucial component of balance. In a systematic review on the subject, it was found that bone mineral density does not increase but can be maintained through exercise in cancer patients.[43] Another systematic review on vibration therapy in cancer patients revealed that this method enhances lower extremity strength, increases bone mineral density, reduces the number of falls, and improves balance.[44]

Adequate sensory input is vital for sustainable balance. A study on the effects of exercise in reducing balance issues caused by chemotherapy-induced neuropathy implemented an 8-week multimodal exercise program. This program included strength exercises (utilizing a treadmill and dumbbells), balance exercises (in single leg and tandem positions), and tempo walking (at an intensity of 13-15 RPE). While nerve conduction velocities did not objectively increase after the program, subjective complaints of neuropathy decreased, balance parameters improved, and participants' quality of life enhanced.[45]

Older individuals need proprioceptive information more than younger individuals due to reduced visual input. As a result, deficits in this system affect them more. Proprioceptive training typically involves simple to difficult exercises, progressing from fixed to moving surfaces, where visual and auditory stimuli are gradually reduced, the support surface is reduced, and the floor is varied (hard and soft surfaces). In one study, regular exercise,

including proprioceptive training, three days a week was recommended to prevent falls in the elderly. It was also stated that tempo walking should be avoided for individuals with balance problems to prevent falls.[46]

Interactive-sensor-based training can enhance proprioceptive sensory mechanisms. In a study involving cancer patients over 60 years old with neuropathy, feedback was provided to patients regarding antero-posterior-lateral oscillation and lower extremity movement errors. Consequently, both balance and gait parameters improved. This system was considered safe for advanced neuropathic cases and individuals with a high fear of falling.[47]

Sole sensation is very important for sensory input, especially in older people who have balance problems and are at high risk of falls. Therefore, it is very important for individuals to feel the sole pressure. Accordingly, shoes with high collars and thin, hard soles that facilitate clear ground feel are recommended.[48]

Adequate activation of the cerebellum is pivotal for balance. Recent studies have demonstrated the cerebellum's role as a sensory-motor center, with weakening of the cerebellum having implications for both balance and cognitive-psychological functions.[49] This interaction is bidirectional, and cerebellar activation can be enhanced through bidirectional applications. Consequently, cognitive tasks can be integrated into balance exercises to improve balance efficacy. Exercises incorporating cognitive tasks, such as predicting stepping locations in advance or singing during balance exercises, are termed dual-task net-step exercises. Studies have indicated that such exercises not only improve balance and gait but also enhance cognitive skills.[50, 51]

Visual biofeedback methods can effectively aid balance rehabilitation. For patients capable of tolerating it, the Wii Balance Board can be utilized with or without activity in front of a mirror. In patients with good condition, activities such as lying on the balance board and playing with a ball can enhance balance. Patients can also be instructed in Otago exercises for home practice, which help them identify deficiencies while performing the exercises.[52]

Virtual reality therapy is increasingly utilized in physiotherapy across various fields. According to a systematic review, engaging in virtual reality sessions at least twice a week for 30 minutes each, totaling 10 sessions, improves balance. Some applications extend session durations to one hour, yielding similar benefits. Virtual reality applications have been found to enhance static and dynamic balance, postural stability, and gait parameters in

the elderly.[53] Additionally, virtual reality applications are actively employed in cancer patients undergoing chemotherapy to alleviate pain. Although their contribution to reducing chemotherapy side effects remains uncertain, they are believed to promote relaxation through distraction.[54, 55]

Postural instability and loss of balance increase the risk of falls in cancer patients, with the addition of fatigue and sleep problems further exacerbating this risk.[56] Relaxation exercises have been recommended to address these issues.[57]

CONCLUSIONS AND RECOMMENDATIONS

The aging process is associated with an increasing prevalence of balance deficits. Older individuals undergoing cancer treatment or who have survived cancer have significantly higher rates of balance problems and fall risks compared to their cancer-free counterparts. It is recommended to improve balance in cancer patients, addressing all potential losses attributed to cancer treatment, promoting functional activity from the start of treatment, and adding balance exercises to rehabilitation protocols.

Ethics Statement

As this study is a review article, ethical approval is not required. Furthermore, it does not involve any data concerning patients or healthy individuals.

Conflict of Interest

There is no conflict of interest regarding any person and/ or institution

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