The Oncology Patient: Increasing Awareness of Falls Prevention and Advocacy Opportunities

Brett MacLennan PT, DPT, MS, OCS
Debbie Prouthy, MPT, EDD, GCS
NCPTA Fall Conference 2019

Objectives

1. Discuss the overall common rehabilitation concerns in patients with cancer and the role of physical therapists.


4. Discuss advocacy opportunities related to cancer patients with cancer and cancer survivors.

Statistics

Greater survivorship means individuals living with lifelong impairments

- 3.3 million (24.5%) cancer survivors report poor physical health
- Cancer survivors almost 3 times more likely to report fair or poor health after treatment as persons without cancer or chronic illness
- 1.4 million (10.1%) cancer survivors report poor mental health
- Twice as likely to have a psychosocial disability and functional limitations as persons without cancer or chronic illness
Common side effects and impairments of cancer and related treatment include:
- Fatigue
- Distress
- Reduced function
- Reduced cognitive capabilities
- Body composition changes
- Compromised immunity
- Lymphedema
- Loss of range of movement
- Pain
- Poor endurance
- Weakness
- Peripheral neuropathy
- Decreased balance
- Bone strength

Important activity and participation domains typically addressed:
- Mobility
  - Changing and maintaining body position
  - Carrying objects
  - Walking and moving around
- Self-care
  - Dressing
  - Bathing
  - Toileting
- Domestic life
  - Carrying a child
  - Doing dishes
- Major life areas
  - Ability to access a classroom for child
  - Ability to work
Falls

According to some studies, 50-75% of all cancer survivors experience a fall.

Population-based research indicates older cancer survivors have a higher fall risk (odds ratio = 1.16-1.17) when compared to individuals without cancer.

History of falling in 12 months prior to cancer diagnosis makes individual almost 4 times more likely to fall shortly after cancer treatment decision.

Individuals with advanced malignant neoplasms (stage IV cancer) have up to a 50% increased risk of falling in next 6 months compared with people without cancer regardless of age.

Prevalence of Balance Problems After Diagnosis

- Falls are associated with:
  - Injuries
    - Head trauma
    - Fractures
    - Contusions
    - Dislocations
    - Other internal injuries
  - Death
  - Fear of falling, loss of confidence
  - Social and Functional decline
  - Nursing home or assisted living placement
  - Reduced functional quality of life
  - Increased anxiety and resulting pain and suffering

Falls have severe consequences in individuals over 65 diagnosed with cancer:

- 62% to 74.2% of those with a history of falls sustained an injury.
- About one-third of older adults who fall require assistance with activities of daily living after fall.
  - Over half (58%) will need help for >6 months.
- Associated with lower health-related quality of life (HRQOL) and greater prospective decline in HRQOL.
- Among older patients hospitalized following fall-related injuries, those with cancer:
  - More likely to die regardless of cancer stage (OR = 2.58).
  - Longer length of stay.

Cost of Falls

- According to Center for Disease Control direct medical costs related to falls in one year totaled:
  - $179 million for fatal falls
  - $19 billion for nonfatal falls
- Average hospital cost for a fall injury is over $34,000 per patient.
  - Cost goes up with age.
Falls Risk\textsuperscript{19,25}

- Systematic review on falls in cancer patients found risk factors established in general population are also associated with falls in oncology populations including:
  - Older age (debatable)
  - Female gender
  - White race
  - Dependence in ADLs
  - Benzodiazepines use
  - Cognitive impairment
  - Abnormal balance and gait
  - Lower physical performance including weakness
  - Prior falls

Risk factors unique to oncology patients:
- Treatment with chemotherapeutic agents
- Advanced cancer stage
- Presence of comorbidities
  - Brain metastases
  - Depression
  - Fatigue
- Falls might be overlooked by healthcare providers
- Decreased compliance with fall risk precautions

Patient History\textsuperscript{19,37,63}

- Patient history/interview should include at a minimum:
  - History of falls or near falls
  - Orientation/cognition
  - Home setup
  - Functional ability (ADLs, IADLs, work, navigate in community, etc)
  - Medical doctor and other services following their case
  - Co-morbidities
    - Changes in vision, sensation, changes in ability to perform ADLs, walking
    - Pain symptoms
    - Medication previous and current including change
      - Research suggests no single polypharmacy cut-point for predicting falls cancer survivors; common definition of five-or-more-medications is reasonable for identifying ‘at-risk’ patients
      - Medication review
  - Cancer
  - Recent testing
    - Blood work
    - Anemia
    - Metastases
    - Cardiac and pulmonary testing
  - Goals
## Body Function and Structure

Balance issues in cancer patients and survivors may arise from impairments (ICF: body function and structure) in multiple systems:

- Balance
- Sensory integration
- Sensation
- Strength
- Vision
- Muscular endurance
- Aerobic capacity
- Fatigue
- Mobility/function
- Cognitive impairments
- Pain

## Impairments

### Cancer related fatigue

- Self-reported fatigue associated with greater likelihood of falls
- One of the identified risk factors for falls in cancer patients in the inpatient setting
- Older adults with cancer reporting fatigue and sleep disorders often are at high risk of further functional decline

#### Assessment

- Screen for sleep issues and/or depression and make proper referrals
- Improving quality of sleep is helpful, increased amount of “rest” is not effective
- Treatment of chronic pain and depression shown to decrease cancer related fatigue

#### Outcome measures:

- 10-point Numeric Rating Scale for Fatigue- self referral tool
- Fatigue Symptom Inventory
- Piper Fatigue Scale
- Functional Assessment of Chronic Illness Therapy-Fatigue Scale (FACIT-Fatigue Scale)

### Pain

- May be due to malignancy, side effects or after effects of treatment, or other unrelated comorbidities
- One of most common issues addressed by rehabilitation
- 30–50% patients undergoing acute cancer treatment experience pain
- 70% patients with metastatic disease experience pain
- Chronic pain relatively common in cancer survivors

#### Assessment

- Pain can have a large negative impact on quality of life, mobility, and increases the risk of falling in cancer patients
- Pain is a fall risk for cancer patients in the outpatient setting
- Fear of pain may cause functional limitations as much as pain itself

#### Outcome measures:

- Brief Pain Inventory
- Visual Analog Scale
- Numeric Pain Rating Scale
- Profile of Mood States- self report outcome which can assess emotional function and patient’s ability to participate to a physical therapy program
- Distress Thermometer
- Hospital Anxiety and Depression Scale
- General Anxiety Disorder- 2-item Depression Questionnaire

### Distress, anxiety, depression

- Physical disability is a leading cause of emotional distress in cancer survivors
- Distress is more strongly related to level of disability than to the cancer diagnosis itself
- Exercise linked to decreased stress, depression, and anxiety levels

#### Assessment

- Distress anxiety, depression: screen and make appropriate referrals to psychiatrist or psychologist
- Outcome measures:
  - Profile of Mood States- self report outcome which can assess emotional function and patient’s ability to participate to a physical therapy program
  - Distress Thermometer
  - Hospital Anxiety and Depression Scale
  - 2-item Depression Questionnaire
  - General Anxiety Disorder- 2-item

### Impairments

- 70% to 100% of people with cancer
- 90% of patients with radiation therapy
- 80% of patients with chemotherapy
- May already be present in 40% of patients at time of diagnosis, prior to treatment
- May result in significant decreases in physical activity and function
- Contributes to the deleterious physical, cognitive, and emotional changes seen in cancer survivors
- Interferes with function and has significant impact on quality of life
- May affect one’s economic, social, and emotional status

### Impairments

- 2, 4, 10, 24

### Impairments

- 10, 21, 25, 27, 63

### Impairments

- 10, 21, 28, 33, 34, 35

### Impairments

- 10, 19, 25, 27

### Impairments

- 10, 21

### Impairments

- 10, 21, 25, 27, 63
Cognitive function
- Mild to moderate cognitive impairments have been reported in 15% to 75% of cancer survivors.
- Cognitive impairments can persist 2 to 10 years post-chemotherapy treatment and are believed to result from long-term cognitive changes such as the development of dementia.
- Presence of cognitive impairment associated with an increased risk of falls and falls-related injuries in older cancer survivors.
- Deficits in several cognitive domains have been reported in the older cancer survivor including:
  - Visual memory
  - Spatial function
  - Executive function
  - Attention
  - Memory
  - Concentration.
- Some cognitive domains are often used in mobility and gait and if impaired can contribute to falls risk.

Lymphedema
- Extremity swelling resulting from disruption of the lymphatics due to obstruction from a tumor or lymph node dissection.
- Lymphedema exists after surgery for non-breast-cancer-related malignancies, but data documenting this occurrence are less common.
- Lymphedema associated with decreased quality of life.
- Lymphedema specialists:
  - Manual lymphatic drainage
  - Compression garments
  - Weight lifting has been shown to be beneficial.
- Assessment:
  - Lymph circumference measurements
  - Water displacement method.

Muscle strength
- Deficits in muscle strength may arise from any of the following:
  - Tumor-produced inflammatory interleukins that are catabolic.
  - Surgical interventions may damage muscle groups and peripheral nerve tissue.
  - Radiation and chemotherapy can damage muscle or peripheral nerve tissue.
  - Corticosteroids preferentially damage proximal limb muscles.
  - Pain, fear, and fatigue lead to inactivity, causing further loss of muscle strength.
- Age-related sarcopenia leads to muscle weakness that is linked to poor balance and falls.
- Study found significant differences in strength (measured via grip strength) in "falls" vs. "no falls" groups.
- Falls in cancer patients greater in individuals with decreased leg strength.
- Cancer treatment can cause similar muscle wasting that does not reverse in recovery.

Range of Motion
- Deficits in ROM may arise from any of the following:
  - Lax formation following surgery.
  - Damage of a joint following chemotherapy or surgery.
  - Fibrosis caused by irradiation.
- Loss of ROM may occur after radiation is completed and can extend beyond the immediately irradiated joint.
- Loss of ROM may impact patient’s function and ability to maintain balance.
- Radiation files.
  - Conservative management with manual release techniques, stretching exercises, and corticosteroid injections may help.
  - Refer to use of antifibrotic agents, such as pentoxifylline, or botulinum toxin injections.
- Assessment: Goniometry.

Muscle strength
- Clinical measurement of strength:
  - Hand-held dynamometry (HHD) Recommended
    - Isokinetic
    - Testing positions to measure muscular strength do not differ from MMT positions
  - Limp circumference measurements
    - Variability resulting from the strength and size of the tester.
  - Manual muscle test system (MMT)
    - Two primary limitations to using MMT.
    - Repetitions maximum
    - Benefit
    - Provides starting point for strengthening exercises.
    - Limitations.
    - No normative data for cancer patients and survivors.

Grip strength
- Isokinetic
- Hand-held dynamometry (HHD) Recommended
- No normative data for cancer patients and survivors.

Limb circumference measurements
- Limitation
- No normative data for cancer patients and survivors.

Goniometry
- Assessment
- Referral for use of compression garments.

Manual muscle test system (MMT)
- Two primary limitations to using MMT.
- Repetition maximum
- Benefit
- Provides starting point for strengthening exercises.
- Limitations.
- No normative data for cancer patients and survivors.

Corticosteroids preferentially damage proximal limb muscles.

Inverse relationship between executive function and number of falls.

Lymphedema specialists:
- Manual lymphatic drainage
- Compression garments
- Weight lifting has been shown to be beneficial.

Assessment:
- Lymph circumference measurements
- Water displacement method.
Impairments

**Muscular endurance** - ability to sustain a force over time in order to complete an activity
- Muscle endurance deficits are documented after cancer treatment
- Decreased endurance can lead to decreased ability to complete balance related tasks
- Clinical measurement of muscle endurance
  - Seldom assessed in a clinical setting
  - Lack of established reliable and valid clinical methods to test
  - Most studies use some percentage of 1-RM to determine the load, and test endurance using a repetition to failure activity
  - No normative data for age, gender, and muscle group

**Cardiovascular and respiratory**
- **Cardotoxicity**
  - Treatment may damage cardiac myocytes and result in congestive heart failure
  - Radiation striking the heart can cause cardiac and coronary artery scarring, leading to restrictive cardiac disease and coronary artery disease
- **Respiratory**
  - Tumors of the lung are space-occupying causing respiratory impairments
  - Chemotherapeutic agents can damage pneumocytes and the pulmonary parenchyma leading to obliteration of alveoli and dilation of air spaces
  - Chest wall irradiation can damage the lining of the alveoli, leading to toxicities such as pneumonitis and fibrosis

**Hearing and Vestibular Function**
- Hearing and vestibular functions can be affected by tumor growth or by chemotherapy
- Hearing impairments may require a referral if detected
- **Vestibular**
  - Vestibular schwannoma, a relatively rare benign tumor, can impair vestibular function
  - Cisplatin, a chemotherapy drug, has been associated with both vestibular toxicity and ototoxicity
- **Assessment**
  - Finger rub test
  - Balance assessment
  - Vestibular ocular reflex (VOR) testing
  - Dynamic Visual acuity test
- **Outcome measures**
  - Dizziness Handicap Inventory Questionnaire

**Sensory**
- Most common cause of sensory impairment is chemotherapy induced peripheral neuropathy
  - Characterized by: paresthesias, dysesthesias, decreased touch pressure thresholds, decreased vibration thresholds, decreased proprioception, reduced deep tendon reflexes
- Other common cause: compression secondary to tumors
- Increases risk of postural control impairments, falls, and gait alterations
- **Assessments**
  - Sensation testing (light and sharp touch)
  - Vibration testing
  - Reflex
  - Thermal stimuli
  - Touch pressure threshold testing
  - Outcome measures:
    - Modified Total Neuropathy Score
    - Functional Assessment of Cancer Therapy-Neurotoxicity

**Balance, gait, and sensory integration**
- **Single leg stance**
  - Adults unable to balance on 1 limb for 5 seconds had 2.1 times risk of fall with injury
  - No normative data for cancer population
- **Full tandem stance**
  - Limitations in full tandem stance found to be a predictor of falls in older cancer survivors (OR=1.48)
- **Cancer or cancer treatments can alter gait characteristics; assessments include**
  - Kinematic analysis
  - Gait speed measurements
- **Cancer survivors have difficulty integrating sensory information from different sources**
  - Modified Clinical Test of Sensory Interaction in Balance

Outcome Measures

- Fullerton Advanced Balance Scale highly recommended
  - Multidimensional tool evaluating various domains through series of 10 diverse activities that challenge static and dynamic balance by altering vision and support surface or by testing activities such as reaching or jumping forward
- Gait speed highly recommended
  - Requires minimal equipment, instruction, and time
  - Coined the "sixth vital sign"
  - Reliable, valid, and predictive of falls
  - Gait speeds and associate increased risk ratio (IRR) for falls <0.6 m/sec, IRR for indoor falls 2.27
    - 2.6 and <1.0 m/sec IRR for indoor falls 1.45
    - 2.3 m/sec IRR for outdoor falls 2.1
  - Gait speed decline of >0.15 m/sec/year IRR for all falls 1.86

Chemotherapy Induced Peripheral Neuropathy (CIPN)

- Side effect of chemotherapy
  - Influence of chemotherapy on fall risk is related to toxicity and dosage of agents
- Manifestations of CIPN includes:
  - Common symptoms
    - Sensory: pain, paresthesias (stocking, glove distribution), reduced vibratory and proprioception
  - Less common symptoms
    - Motor: muscle cramps, weakness, ataxia, gait disturbances
    - Autonomic dysfunction: orthostatic hypotension, bowel/bladder dysfunction, irregular pulse
- Prevalence:
  - 68.1% in first month after chemo
  - 60.0% at 3 months after chemo
  - 30.0% at 6 months and longer
- CIPN may lead to:
  - Fear of falling
  - Difficulty walking
  - Increased fall risk
  - Decreased distal LE strength, pain, loss of sensation, including proprioception
  - Increased risk for falls and balance deficits
  - Individuals with CIPN 2.7 times more likely to fall when compared with patients with cancer without CIPN
  - 20% of the patients with CIPN who had a fall required medical attention
  - Recovery is frequently delayed over the course of months or years
  - Individual variations:
    - Age
    - Comorbidities
    - Predisposing factors: smoking and/or alcohol use

CIPN

- Patients at greater risk
  - Higher dose of medication and/or use of multiple agents
  - Pre-existing neurological damage:
    - Diabetes
    - Alcoholism
    - Nutritional deficiencies
    - Lyme disease
- Prognosis for recovery
  - Depending on mechanism of damage: recovery significantly diminished for damage of the dorsal root ganglion
  - Recovery is frequently delayed over the course of months or years
  - Individual variations:
    - Age
    - Comorbidities
    - Predisposing factors: smoking and/or alcohol use
### CIPN\(^{17,18}\)

<table>
<thead>
<tr>
<th>Chemotherapeutic Agent</th>
<th>Common Symptoms of CIPN</th>
<th>Mechanism</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Taxane:</strong> Paclitaxel</td>
<td>Distal sensory</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Decreased postural control</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Higher doses motor and autonomic dysfunction</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Microtubule inhibition</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Impaired axonal transport</td>
<td></td>
</tr>
<tr>
<td></td>
<td>May cause microtubule tangles in dorsal root ganglion and Schwann cells</td>
<td></td>
</tr>
<tr>
<td><strong>Taxane:</strong> Docetaxel</td>
<td>Same as paclitaxel usually less severe</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Microtubule inhibition</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Impaired axonal transport</td>
<td></td>
</tr>
<tr>
<td></td>
<td>May cause microtubule tangles in dorsal root ganglion and Schwann cells</td>
<td></td>
</tr>
<tr>
<td><strong>Platinum Drugs:</strong> Cisplatin</td>
<td>Distal sensory neuropathy</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Motor loss is less common</td>
<td></td>
</tr>
<tr>
<td></td>
<td>May lead to vascular toxicity</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Microtubule inhibition</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Impaired axonal transport</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Apoptosis in dorsal root ganglion</td>
<td></td>
</tr>
<tr>
<td><strong>Platinum Drugs:</strong> Carboplatin</td>
<td>Same as cisplatin but less severe</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Microtubule inhibition</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Impaired axonal transport</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Apoptosis in dorsal root ganglion</td>
<td></td>
</tr>
</tbody>
</table>

### Assessment:
- Difficult as objective measures may not pick up on initial subjective complaints

### Evaluation may include:
- Electrophysiological testing
- Sensory testing
- Neurological assessment
- Gait assessment
- Balance assessment
- Impact on patient’s quality of life and ADLs

### CIPN treatment
- **Pharmacological**
  - Dosing options
  - Simultaneous administration of neuroprotective agents
  - Animal studies
  - Nerve growth factors
  - Insulin like growth factor
  - Vasoendothelial growth factor
  - Infusion with calcium and magnesium
  - NSAIDS, narcotics, gabapentin
- **Nutrients**
  - Vitamin E (antioxidant)
  - Glutamine

### Nonpharmacological
- Assess for possible nerve entrapments contributing to nerve symptoms
- Preliminary evidence suggests physical rehabilitation may improve balance and mobility even as neuropathy persists
  - Gait, balance, strength training
  - Systematic review therapeutic exercise does NOT appear to be detrimental to recovery
  - Benefits: less fatigue, greater cardiovascular endurance, increased strength
  - Assistive devices as appropriate
  - Improved ankle flexibility and strength shown to improve balance and stability during gait in diabetic peripheral neuropathy
- Modalities?
CIPN

- Patient education
  - Improved ability to manage side effects of chemotherapy when educated and able to anticipate the symptoms prior to onset
  - Unexpected symptoms promote increased anxiety and distress
  - Education on safety and proper footwear, home modification, foot check, improves patient safety
  - Education on orthostatic hypotension for those with autonomic dysfunction

Safety Concerns with Assessment and Interventions

Safety Parameters for Activity Participation

<table>
<thead>
<tr>
<th>Reference Range</th>
<th>Interpretation</th>
</tr>
</thead>
<tbody>
<tr>
<td>WBC (N=4k–11k)</td>
<td>ANC 1500–1000/μL</td>
</tr>
<tr>
<td>(ANC) &lt; 1000/μL</td>
<td>Patient needs mask and MD approval to ambulate in hall.</td>
</tr>
<tr>
<td>Hemoglobin: ♂ 13–18 g/dL</td>
<td>↓ &lt; 10 g/dL</td>
</tr>
<tr>
<td>Hemoglobin: ♀ 12–16 g/dL</td>
<td>↓ 9–10 g/dL</td>
</tr>
<tr>
<td>Hematocrit: ♂ 42–52%</td>
<td>↓ &lt; 20%</td>
</tr>
<tr>
<td>Hematocrit: ♀ 37–48%</td>
<td>↓ &lt; 20%</td>
</tr>
<tr>
<td>Platelets (N=150k–450k)</td>
<td>↓ &lt; 50k</td>
</tr>
<tr>
<td>Platelets: &lt; 20k–35k</td>
<td>Light exercises; no bicycle, treadmill, AHV, NuStep, UE ergometer, ambulate as tolerated</td>
</tr>
<tr>
<td>Platelets: &lt; 20k</td>
<td>Guarded therapy intervention, High risk for bleeding into extracellular space; Watch bleeding times; ARDIH and sitting/standing as tolerated</td>
</tr>
</tbody>
</table>

Interventions

- Resistance training
  - Resistance training can reverse muscle weakness, restore balance, and reduce falls and functional decline in older adults without cancer
  - Literature supports use of exercise in improving strength and balance in older adults with postural instability, or high risk for falls
  - Growing body of literature indicating persons with peripheral neuropathy benefit from strength and balance interventions
  - Repeatedly demonstrated to be safe, even among patients at very high risk of falls
Lower limb closed kinetic chain exercises
- Cancer survivors with CIPN demonstrated:
  - Decrease in tingling sensation and pain
  - Increased awareness of pin prick and vibration sensation in lower extremities
  - Improved scores on the modified total neuropathy score
  - Improvements on the Berg Balance Scale

Combination of strength and aerobic training
- 12 week exercise program:
  - Students trained progressively from 10 minutes to a goal of 30 minutes per day
  - Upper extremity resistance training at least 3 times per week
  - Cancer survivors with CIPN symptoms demonstrated:
    - Decrease in CIPN symptoms
    - Improvement in gait speed
    - Improvement in balance
- 36 week exercise program:
  - No ad lib, follow a week
  - Heading posture stability exercises
  - Upper and lower extremity endurance exercise
  - Participants demonstrated in line of 70% to 80% maximal heart rate
  - Patients with lymphoma demonstrated:
    - Improvement in quality of life
    - Improvement in balance
- 13 week program:
  - Functional core and whole body bone mineral density improved
  - Decreased sway velocity with eyes open and eyes closed
  - Improvement in lower body strength

Combination of functional balance exercises and strength training
- 20 minutes of strength training, 20 minutes of balance training, 10 minutes of stretching, and 10 minutes of functional balance training

Interactive sensor-based balance training
- Sensory deficits can lead to inadequate proprioceptive feedback and abnormal somatosensory feedback leading to increased fall risk
- Interactive exergaming and virtual-reality systems enhances visual and proprioceptive information about joint movements in order to compensate for deteriorated proprioception

Program:
- Visual computer feedback balance training

Shown to make improvements in following areas:
- Decrease hip sway in feet-closed and semi-tandem positions and semi tandem
- Decreased ankle sway in feet-closed and semi-tandem positions
- Decreased center of mass sway in feet-closed and semi-tandem positions
- Improve Berg Balance Scale scores

Orthoses and orthotics
- Consider bracing for those with impairments in a given area that may increase risk for falls (i.e. decreased sensation in lower limbs, foot drop)

AFOs may
- Substitute for lack of proprioceptive feedback and improve automatic postural responses
- Improve hip, ankle, and center-of-mass away
- Reduce fear of falling

Cases report comparing orthotic barefoot, shoes only, and orthotic use found orthotics improved:
- Gait speed
- Balance
Interventions

Tai Chi
- Promising results for impact of Tai Chi on individuals with diabetic peripheral neuropathy
  - Increased lower extremity strength
  - Increased balance
  - Increases stamina
- Not yet studied in chemotherapy induced peripheral neuropathy

Can Exercise Improve Cognition?
- Moderate and high-intensity resistance exercise may improve several cognitive domains (STM, LTM, attention span)
- Resistance exercise contributes to functional plasticity in brain regions associated with executive function
- Aerobic exercise appears to preferentially benefit executive functions
- 6 months of aerobic and strength exercises resulted in significant cognitive and functional improvements with medium to large effect size
- Exercise volume that is neuroprotective is similar to recommended volume for older adults

Education
- Patient and family education:
  - Adaptive equipment
  - Home modifications
  - Disease/treatment progression
  - Importance of rehabilitation/exercise
- Healthcare providers education:
  - Educating health professionals on importance of multicomponent exercise during and after treatment
  - Educating health professionals on benefits of physical therapy
  - Educating nurses on fall prevention, gait belts, CIPN, and to take high-risk patients to bathroom every two hours
    - Falls reduced by 50% within 6 months
    - More effective than educating patient and family members in hospital

Importance of Overall Health
- Overall burden of comorbidities associated with worse survival rate and decreased quality of life in patients with cancer
- Several studies found cancer patients with comorbidities:
  - Less likely to receive curative treatment for their cancer
  - Less likely to tolerate treatment for their cancer
  - Often have higher rate of complications

Health and Human Services Recommendations
- Multicomponent:
  - Aerobic physical activity with goal of 150-300 minutes of moderate intensity for the week
  - 2 or more days of strength training
  - Older adults: include balance exercises
- Move more sit less
  - Some physical activity is better than none
- Small bouts of exercise throughout the day can be just as effective as exercising for 30-45 minutes straight
**Physical Activity**

Exercise can play major roles for cancer survivors and in cancer prevention.

- Cancer prevention: more than 30% of cancers can be prevented by modifying or avoiding key risk factors:
  - Being overweight or obese
  - Physical inactivity
  - Low fruit and vegetable intake
  - Alcohol use
  - HPV-infection
  - Urban air pollution

- Cancer survivors:
  - Lessen physical side effects
  - Lessen psychosocial side effects
  - Improve cardiovascular system
  - Improve survival rate
  - Improve immune function
  - Help restore pro-inflammatory/anti-inflammatory homeostasis
  - Reduce health care costs
  - Improve quality of life

---

**Physical Activity**

- “Pharmaceutical companies are spending billions of dollars to try to replicate what muscle can do naturally.” Angelo Rizzo, MS, PT, CLT

- “Power of physical therapy to improve the health and well-being of patients who have undergone treatment for cancer is practically undisputed.” Dan Neel

---

**Rehabilitation Needs**

- Despite proven benefits only 1-2% of cancer survivors in the United States are referred to physical rehabilitation.

- 202 people in outpatient cancer treatment:
  - 65.8% reported experienced functional problems
  - 23.9% reported having trouble walking
  - Two of 202 participants were referred to physical therapy

- Cancer survivors less likely to be physically active
  - Estimated that <10% of cancer survivors will be active during treatments and only 20%-30% will be active after treatments

---

**Is the patient too sick? Will it make them worse?**

- Studies show the most deconditioned and frail patients make the greatest improvements in impairments including posture, strength, balance, endurance

- Systematic review of physical activity interventions in cancer survivors, during and after treatment, showed physical activity had a significant positive effect on morbidity and mortality and was well tolerated

- American College of Sports Medicine concluded exercise training is safe during and after cancer treatments

---

**Rehabilitation Needs**

- Physical therapy often underutilized throughout the entire continuum of care; likely due to several factors including:
  - Lack of consensus as to when or even if to initiate exercise
  - Impression exercise may exacerbate cancer-related symptoms
  - Physicians may feel patients are too frail for exercise
  - Lack of communication with patient regarding exercise
  - Weak interface between oncology and rehabilitation services
  - Lack of understanding of importance of a comprehensive program of care that incorporates rehabilitation
  - Under diagnosis of impairments
  - Physical therapists lack of knowledge on proper treatments

---

**Is the patient too sick? Will it make them worse?**

- Study comparing response to interventions between “complex” patients to “non-complex”
  - Programs based on American College of Sports Medicine on exercise guidelines for cancer survivors were well tolerated with no significant complications

- Study reviewed impact physical therapist prescribed, supervised exercise program (aerobic vs strength training) on people with stage IV cancer (metastasis present)
  - Significant improvements:
    - Fatigue
    - Gait speed
    - Improvement in Short Physical Performance Battery
  - No adverse effects reported and both groups reported satisfaction with the exercise program
Is the patient too sick? Will it make them worse?43

- Study investigated early mobilization program of cancer patients requiring mechanical ventilation (MV) for acute respiratory failure in the intensive care unit (ICU)
  - No documented adverse events
  - Patients received average of:
    - Average of 5 OT and 5 PT sessions in the ICU
    - Increase in the functional and cognitive scores
    - Increased number of OT/PT encounters beginning in ICU shown to reduce hospital length of stay

Falls and hospice patients with cancer
- 50% of patients diagnosed with advanced cancer fall during the subsequent 6-month time frame
- Impact of falls on hospice and cancer patients include:
  - Reduced functional quality of life
  - Increased anxiety
  - Pain and suffering

- Systematic review concluded physical therapy and exercise among hospice patients with cancer is tolerated and has following impact:
  - Reduces falls
  - Improves health status
  - Improves functional mobility
  - Improves strength

When do I send them? Knowledge of Benefits3,4,10,16
- Systematic review shows positive effect of rehabilitation at all stages of disease:
  - Reduces fatigue
  - Improves tolerance to treatment
  - Improves time to recovery
  - Improves sleep
  - Improves cardiovascular function
  - Improves health-related quality of life
  - Enhances immune function
  - Reduces fall risk
  - Improves cognitive function

- Expanding literature including systematic reviews and meta-analysis identify a positive benefit of exercise across the continuum of care and can reduce physical impairments at every stage of treatment
  - Prehabilitation
  - During treatment
  - Acute rehabilitation
  - Rehabilitation for chronic impairments

When do I send them? Knowledge of Benefits15
- Prehabilitation:
  - Establish baseline
  - Anticipates future impairments
  - Builds reserve
  - Reduce fear
  - Establish therapeutic alliance
  - Opportunity to educate on adverse signs and preventive strategies

When do I send them? Knowledge of Benefits15
- During active treatment:
  - Reduces fatigue
  - Increases functional gains
  - Improves aerobic capacity
  - Improves strength
  - Improves range of motion
  - Reduces pain
  - Improves emotional well-being
    - Less anxiety and depression
    - Improves self-efficacy
    - Improves self-esteem
  - Improves body image
  - Improves body mass index
  - Decreases bone loss
  - Decreases disease recurrence
  - Decreases secondary diseases

- After treatment:
  - Progress toward recovery
  - Gain sense of normality
  - Rebuild structure in their life
  - Lower rate of disease recurrence
  - Improves survival
  - Enhances quality of life

http://tirr.memorialhermann.org/patient-stories/leigh-rozelle/
With obvious benefits of rehabilitation why are more individuals not being referred?

**Increasing Referrals**

- Poor communication between physical therapy departments and oncology staff leave:
  - Oncology staff unaware of the benefits of rehabilitation
  - Patients unaware of the benefits of rehabilitation
  - Oncology staff not knowing where to send the patient for rehabilitation

**Group in Canada investigated ways to improve rehabilitation utilization among cancer patients both during and after treatment**

**Assessment of 2 month sample of referrals after intervention found:**
- 71% from multidisciplinary team (nurse coordinators, nutritionists, social workers)
- 37% direct referrals from treating oncologists
- 13% self referral
- 14% from psychosocial services

**How did they improve referrals?**
- Provided:
  - Clinical and scientific overviews of the value of rehabilitation and exercise interventions to departments responsible for treating specific tumor sites
  - Guidelines for referrals
  - Emphasizing all patients eligible for an initial evaluation regardless of referral guidelines, particularly if their functional performance has declined

**Guidelines for referral:**
- Significant decrease in activity level (<3–4 MET-hours per week)
- Fatigue (VAS > 3/10)
- Persistent shortness of breath
- Muscular weakness, steroid-induced myopathy
- Loss of balance or coordination, or both
- Risk of falls
- Loss of mobility (ability to climb stairs, perform transfers, ambulate safely) or need for ambulation aids, or both
- Bone metastasis, avascular necrosis, risk of pathologic fracture, and extensive orthopedic stabilization procedures
- Osteopenia or osteoporosis (pre-existing or at risk because of treatment)

**Critical survivors are screened for both psychological and physical impairments and referred appropriately to trained rehabilitation health care professionals**

**Routine screening for physical impairments (in addition to distress and other issues) and appropriate referrals to rehabilitation will:**
- Improve function
- Reduce disability
- Lower direct and indirect healthcare costs
- Increased physical and psychological Health Related Quality of Life

**STEADI algorithm first asks patients answer 3 key questions:**
- 3 key questions:
  - “Fell in the past year? If YES ask, How many times? Were you injured?”
  - “Feels unsteady when standing or walking?”
  - “Worries about falling?”
- “Yes” to any key question gait, strength, and balance should be evaluated

**History of falls odds ratio for future fall 6.81**

**74% sensitivity and 69% specificity for identifying a fall used a positive history of falls**
Increasing Referrals\textsuperscript{19,58}

- Gait speed \textbf{highly recommended}
  - Gait speed is reliable, valid, and predictive of falls, function, and mortality in cancer survivors, older adults, and neurologic populations
  - Gait speeds and associated increased risk ratio (IRR) for falls:
    - \(<0.6\ m/\text{sec};\ IRR\ for\ indoor\ falls=2.17\)
    - \(\geq0.6\ \text{and}<1.0\ \text{m/sec};\ IRR\ for\ indoor\ falls=1.45\)
    - \(\geq1.3\ \text{m/sec};\ IRR\ for\ outdoor\ falls=2.11\)
    - Gait speed decline of \(>0.15\ \text{m/\text{sec/year}};\ IRR\ for\ all\ falls=1.86\)

Lack of Knowledge of Physical Therapists\textsuperscript{3}

- Attend continuing education
- Become member of APTA’s Academy of Oncologic Physical Therapy ($30 annual membership fee)
  - Includes subscription to Rehabilitation Oncology
  - https://oncologygd.org/
- Comprehensive set of guidelines currently available for exercise and the oncology patient through American College of Sports Medicine
- Complete an American Board of Physical Therapy Residency and Fellowship Education (ABPTRFE) accredited residency in Oncology
- Become a board certified specialist in Oncology through the ABPTRFE

References

