Contemporary Oncology Rehabilitation Education and Practice

LISA VANHOOSE, PHD, MPH, PT, CES, CLT, CKTP
Objectives
1. Review the pathophysiology of cancer
2. Describe the medical management of cancer
3. Describe common side effects of cancer and its treatment
4. Identify outcome measures with high validity, reliability, and clinical utility for use with cancer survivors and caregivers
5. Differentiate between the knowledge, skills, and attitudes of the entry-level therapist, the experienced therapist, and the specialist and their integration with an oncology rehabilitation program
6. Develop and progress an oncology rehabilitation plan of care based on the current literature and the patient’s needs, beliefs, and values
What is Cancer?

“An abnormal mass of tissue that results when cells divide more than they should or do not die when they should. Tumors may be benign (not cancer), or malignant (cancer). Also called neoplasm.”

Defining features
◦ Abnormality
◦ Uncontrollability
◦ Invasiveness

Greek “carcinos”
◦ Translates to “crab”,
◦ finger-like spreading projections

http://training.seer.cancer.gov
http://www.cancer.gov/dictionary
Cellular Adaptations

“Plasia”: growth, cellular multiplication
Cancer Diagnostics

- Site
- Physical Examination
- Biopsy
- Imaging
- Histology
- Tumor Markers
- Grading
- Staging
## Tumor Type Generalizations

<table>
<thead>
<tr>
<th>BENIGN</th>
<th>MALIGNANT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Typically slow growing</td>
<td>Rapid or slow growth</td>
</tr>
<tr>
<td>Localized</td>
<td>Invasive</td>
</tr>
<tr>
<td>Not invasive (unrelated tissues/organs)</td>
<td>Encapsulated</td>
</tr>
<tr>
<td>Not cancerous</td>
<td>Cancerous</td>
</tr>
<tr>
<td>Recurrence unlikely</td>
<td>Possible recurrence</td>
</tr>
<tr>
<td>Encapsulated</td>
<td>End in “oma”</td>
</tr>
<tr>
<td>End with &quot;oma&quot;</td>
<td>◦ more description regarding pathology</td>
</tr>
<tr>
<td>◦ regardless of their cell type</td>
<td>◦ Organ or cell of origin</td>
</tr>
</tbody>
</table>
# Staging a Tumor: TNM

<table>
<thead>
<tr>
<th>Primary Tumor (T)</th>
</tr>
</thead>
<tbody>
<tr>
<td>TX</td>
</tr>
<tr>
<td>T0</td>
</tr>
<tr>
<td>Tis</td>
</tr>
<tr>
<td>T1, T2, T3, T4</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Regional lymph nodes (N)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nx</td>
</tr>
<tr>
<td>N0</td>
</tr>
<tr>
<td>N1, N2, N3</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Distant metastasis (M)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mx</td>
</tr>
<tr>
<td>M0</td>
</tr>
<tr>
<td>M1</td>
</tr>
</tbody>
</table>
Bone is the most likely site for metastases of any type of cancer.
Tumor Grading

How different do the cells appear compared to the cells from which they originated?

Have the cells started to multiply before they are mature?

The sooner the cells divide, the “wilder” they become appearance and behavior.
### Tumor Grading Systems

#### Unspecified Tumor Type

- **GX:** Grade cannot be assessed (undetermined grade)
- **G1:** Well differentiated (low grade)
- **G2:** Moderately differentiated (intermediate grade)
- **G3:** Poorly differentiated (high grade)
- **G4:** Undifferentiated (high grade)

#### Breast Cancer Nottingham Scale

- **Tubule formation:** how much of the tumor tissue has normal breast (milk) duct structures
- **Nuclear grade:** an evaluation of the size and shape of the nucleus in the tumor cells
- **Mitotic rate:** how many dividing cells are present, which is a measure of how fast the tumor cells are growing and dividing
- **Total score**
  - 3–5: G1 (Low grade or well differentiated)
  - 6–7: G2 (Intermediate grade or moderately differentiated)
  - 8–9: G3 (High grade or poorly differentiated)

#### Prostate Cancer Gleason Score

- **Gleason X:**
  - Gleason score cannot be determined
- **Gleason 2–6:**
  - The tumor tissue is well differentiated
- **Gleason 7:**
  - The tumor tissue is moderately differentiated
- **Gleason 8–10:**
  - The tumor tissue is poorly differentiated or undifferentiated
Cancer Treatment Typically Requires a Multimodality Approach

Think of cancer in terms of local, locoregional, and systemic categories

Surgical Oncology
Medical Oncology
Radiation Oncology

Local → Locoregional → Systemic

Surgery → Radiotherapy → Chemotherapy, Immumotherapy, Hormones, Biologic Therapy
Treatment Approaches

Adjuvant Therapy
- Additional cancer treatment given after the primary treatment to lower the risk that the cancer will come back.
- May include chemotherapy, radiation therapy, hormone therapy, targeted therapy, or biological therapy.

Neoadjuvant Therapy
- Treatment given as a first step to shrink a tumor before the main treatment, which is usually surgery.
- Examples include chemotherapy, radiation therapy, and hormone therapy. It is a type of induction therapy (first in a series of therapeutic measures taken to treat a disease).

Concurrent Therapy
- Refers to administering medical treatments at the same time as other therapies, such as radiation.
Chemotherapy

Any drug used to treat disease
- **Systemic** method of cancer treatment
- Tailored

Administration
- Oral
- Intramuscular injection
- Subcutaneous injection
- Intravenous chemotherapy
- Intrathecal chemotherapy
- Multiple methods simultaneously

- **Combination chemotherapy**
- **Goal**
  - Cure
  - Control
  - Palliation
- **Timing**
  - Neoadjuvant, induction, or preoperative
  - Adjuvant chemotherapy
  - Palliative
Radiation Therapy

Goal
- Curative or palliative

Timing
- Neoadjuvant
- Intraoperative (IORT)
- Adjuvant

Methods
- External beam radiation
- Internal radiation (brachytherapy)
- Systemic
Internal Radiation

- Implant radiation therapy, internal radiation therapy, and radiation brachytherapy
- Liquid radiation
- Needles, seeds, wires, or catheter placed within an incision
  - Interstitial
  - Intracavity
    - Mammosite, SAVI, Axxent
- Low dose rate implants
  - 1 to 7 days
- High dose rate implants
  - Twice a day for up to 5 days
  - Once a week for 5-7 weeks
- Permanent implants
Radiation Therapy

Total dosage
• 40 Gy + - skin effects
  • Hair loss can occur with >1Gy
  • Dryness of glands
• 50 Gy + - bone effects
• 60 Gy + - soft tissue effects
• 70 Gy + - muscle and tendon effects

The dose of radiation is defined as the irradiation absorbed by each kilogram of tissue expressed as Grays (Gy) - 1 Gy = 1 J/kg of tissue.
• The dose is usually given in a number of daily fractions
  • 1-2 Gy
• Total dose determined by tumor sensitivity and tissue tolerance

*Advances in radiotherapy, BMJ 2012; 345*
Adverse effects of radiotherapy

Acute effects

Occur in rapidly proliferating tissue
Tend to cause inflammation
Usually reversible

Examples: Dermatitis, Mucositis, Cystitis, Proctitis, Hair loss, Bone marrow suppression

Fibrosis
Proliferation of surviving fibrocytes owing to growth factors released as a result of injury

Examples: Hardening and shrinkage of an irradiated breast, Strictures and malabsorption of irradiated small bowel

Atrophy
Loss of fibrocytes and collagen reabsorption

Examples: Telangiectasia in the skin, Bleeding, e.g. haematuria, Ischaemia resulting in bowel perforation and formation of fistulae

Vascular damage
Either small vessel dilation or constriction

Late effects

Infertility

Hormone deficiencies

Second malignancies
Hormonal Therapy

Stops or slows the growth of cancer that uses hormones to grow.
- Block body’s ability to produce hormones
- Interfere with hormone behavior in the body

Used to treat prostate and breast cancers
- Most often used with other cancer treatments
- Neoadjuvant before surgery or radiation
- Adjuvant to lower risk of recurrence
- Cancer recurrent or metastatic spread
- Ease cancer symptoms when surgery or radiation is not an option
Targeted Therapy

Drugs that target specific genes or proteins found in cancer cells or cells related to cancer growth

- Block or turn off signals that tell cancer cells to grow and divide
- Keep cells from living longer than normal
- Kill cancer cells

Two types of targeted therapy

- Monoclonal antibodies
- Small-molecule drugs
“An individual is considered a cancer survivor from the time of diagnosis, through the balance of his or her life. Family members, friends, and caregivers are also impacted by the survivorship experience and are therefore included in this definition.”

Cancer Survivorship

As of January 1, 2016, 15.5 million Americans have a history of cancer (4.8% of the population)

By January 1, 2026 this number will increase to 20.3 million

Median age at diagnosis in U.S. across all cancer types is 66 years old

Most common cancers among survivors
- Male—prostate (44%), colon and rectum (9.8%), and melanoma (8%).
- Female—breast (43.6%), uterine corpus (9.2%), and colon and colon and rectum (8.9%).
Incidence Rates

New Cancer Cases, 2018
- Breast: 268,670 (53%)
- Lung and bronchus: 234,030 (15%)
- Prostate: 164,690 (13%)
- Colon and rectum: 140,250 (9%)
- Other: 927,710 (8%)

Cancer Deaths, 2018
- Lung and bronchus: 154,050 (25%)
- Colon and rectum: 50,630 (8%)
- Pancreas: 44,330 (7%)
- Breast: 41,400 (7%)
- Other: 319,230 (8%)

# Lifetime Risk of Developing or Dying from Cancer

## MALES: ALL INVASIVE SITES

<table>
<thead>
<tr>
<th>Risk of Developing</th>
<th>Risk of Dying</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 in 2 (42.05%)</td>
<td>1 in 4 (26.62%)</td>
</tr>
</tbody>
</table>

## FEMALES: ALL INVASIVE SITES

<table>
<thead>
<tr>
<th>Risk of Developing</th>
<th>Risk of Dying</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 in 3 (37.58%)</td>
<td>1 in 5 (19.13%)</td>
</tr>
</tbody>
</table>

Survivorship Is on the Rise

5 year survival rate for *all* cancer types has steadily increased (ACS 2009)
- 50% between 1975 to 1977
- 54% between 1984 to 1986
- 66% between 1996 to 2004
- 69% between 2005 to 2011

What is the significance of the 5 year survival rate?
- Risk of dying drops to that of a person who has not had cancer
- Life expectancy returns back to “normal” for given age group
Consequences of Survivorship

Impairment and dysfunction
- Chemotherapeutic toxicities
- Late effects of radiation therapy
- Adverse sequelae of surgical interventions

Work discontinuation/resumption
- Only 60% of patients return to work within 1 to 2 years
- Important to identify remaining 40% with higher risk of lasting absence

Increased caregiver support
- 3 out of 4 families will care for a family member with cancer
### Recent CDC Studies

<table>
<thead>
<tr>
<th>Per capita annual productivity loss</th>
<th>Hospitalization/Rehospitalization</th>
<th>Survivors with an informal caregiver</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Childhood cancer survivors $8169/person</td>
<td>• 4.7 million hospitalizations in 2009</td>
<td>• 25% to 29% caregivers made extended employment changes.</td>
</tr>
<tr>
<td>• Adult cancer survivors $3719-$4033/person</td>
<td>• Cancer survivor annual expenditures $8091-$8412</td>
<td>• 8% of survivors had caregivers who took work leave ≥2 months.</td>
</tr>
<tr>
<td>• Individuals w/o cancer history $3083/person</td>
<td>• Individuals w/o cancer history annual expenditures $3904-$5119.</td>
<td></td>
</tr>
<tr>
<td>• Employment disability accounts for 75%</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Hospitalization/Rehospitalization**

- 4.7 million hospitalizations in 2009
- Cancer survivor annual expenditures $8091-$8412
- Individuals w/o cancer history annual expenditures $3904-$5119.
Prevalence of Side Effects

Canadian based cross-sectional study

68,920 subjects

Ambulatory cancer patients between 2007 and 2009
  ◦ Lung, breast, gastrointestinal, and genitourinary ~ 75% of cases

Outcome measure: symptom scores

Tools: the Edmonton Symptom Assessment System (ESAS) and the Palliative Performance Scale (PPS)

Results
  ◦ The majority reported at least one symptom
    ◦ 1 in 2 reported pain or shortness of breath
  ◦ Those with higher symptom burden
    ◦ Women
    ◦ Lung cancer patients
    ◦ Persons with lower income levels
    ◦ Persons receiving palliative or hospice care

Role of Oncology Rehabilitation

Cancer-related fatigue
Chemotherapy-induced neuropathy (CIPN)
Balance/coordination deficits
Gait abnormality
Lymphedema
Radiation fibrosis
Post-operative limitations
Cardiopulmonary deconditioning

Difficulty swallowing
Weight loss/weight gain
Muscle weakness
Joint and muscle aches
Sleep disturbance
Emotional reactivity
Cognitive changes
Depression
Body image changes
Hormonal side effects

...so why isn’t oncology rehabilitation a standard component of comprehensive oncology care?
Rehabilitation Referral Disparities

The Detection and Treatment of Cancer-Related Problems in an Outpatient Setting

(Cheville et al., Supportive Care in Cancer, Jan 2009, Vol 17, Issue 1)

- 202 patients undergoing outpatient cancer treatment
- 65.8% reported functional problems and 23.9% reported difficulty walking
- Only 2 were given referrals to physical therapy, and those were for pain and limb swelling

Prevalence and treatment patterns of physical impairments in patients with metastatic breast cancer.

(Cheville et al. J Clin Oncol 2008, 26:2621-9)

- 163 women with metastatic breast cancer.
- 92% reported one or more physical impairments
- 88% required physical therapy, but only 21% received treatment
### Screening/Early Detection
- Diet and exercise
- Awareness of risk, signs, and symptoms

### Diagnosis
- Consultation
- Prevent/control deconditioning

### Treatment
- Symptom management
- Preserve function
- Quality of life

### Survivorship
- Long term follow up/surveillance
- Manage late effects
- Rehabilitation
- Health promotion
- Palliative

### End of Life
- Support patient and family

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The diagram illustrates the progression of care throughout the course of illness, from screening to diagnosis, treatment, survivorship, and end of life. The stages include active disease-directed treatment, minimal disease-directed treatment, and no disease-directed treatment, leading to bereavement. Palliative care is integrated throughout, focusing on symptom management, preserving function, and improving quality of life.
Long-Term versus Late-Term Effects

Long-term: Start with treatment and lessens or resolves over time

Late-term: Start after treatment

Depends on the type and stage of cancer, treatments received, dosing of treatments, and age at treatment
# Long-Term and Late-Term Effects

<table>
<thead>
<tr>
<th>Body System</th>
<th>Impairment</th>
<th>Clinical Signs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Musculoskeletal</td>
<td>Decreased bone density</td>
<td>Pain, fractures, kyphosis</td>
</tr>
<tr>
<td></td>
<td>Change in body composition</td>
<td>Cachexia or obesity</td>
</tr>
<tr>
<td></td>
<td>Arthralgia</td>
<td>Decreased mobility</td>
</tr>
<tr>
<td></td>
<td>Decreased muscle strength</td>
<td>Decreased function</td>
</tr>
<tr>
<td></td>
<td>Range of motion loss</td>
<td>Fatigue</td>
</tr>
<tr>
<td>Neurological</td>
<td>Damage to nerve cells</td>
<td>Chronic pain</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Peripheral neuropathy</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Vision/hearing changes</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Fatigue</td>
</tr>
<tr>
<td>Cognitive problems</td>
<td></td>
<td>Deficits in attention,</td>
</tr>
<tr>
<td></td>
<td></td>
<td>concentration, memory, and thought processing</td>
</tr>
<tr>
<td>Balance/coordination deficits</td>
<td></td>
<td>Gait abnormalities</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Fall incidents</td>
</tr>
</tbody>
</table>
# Long-Term and Late-Term Effects

<table>
<thead>
<tr>
<th>Body System</th>
<th>Impairment</th>
<th>Clinical Signs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cardiopulmonary</td>
<td>Left ventricular dysfunction</td>
<td>↓ ADLs</td>
</tr>
<tr>
<td></td>
<td>Decreased ejection fraction</td>
<td>↓ ambulation</td>
</tr>
<tr>
<td></td>
<td>Decreased lung function</td>
<td>↓ stair climbing</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Abnormal vital signs</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Shortness of air</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Accessory breathing</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Fatigue</td>
</tr>
<tr>
<td>Integumentary</td>
<td>Alopecia</td>
<td>Grooming and body image issues</td>
</tr>
<tr>
<td></td>
<td>Tissue Fibrosis</td>
<td>Sensation loss</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Change in skin texture and color</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Decreased skin elasticity</td>
</tr>
<tr>
<td>Lymphedema</td>
<td></td>
<td>Unilateral limb swelling</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Self-reports of heaviness, pain or fatigue</td>
</tr>
</tbody>
</table>
ICF Model

International Classification of Functioning, Disability and Health endorsed in 2001

Mainstreams disability

Provides a universal language for health care providers

- Available in all World Health Organization languages

Body, individual and societal, environmental, and personal factor domains
Assessing the “Whole Person”

Classification of function, disability & health

Health Condition (disorder/disease)

- Structure & function BODY (Impairment)
- Activities INDIVIDUAL (Limitation)
- Participation SOCIETY (Restriction)

Environmental Factors

Personal Factors

Research Committee of the Oncology Section:
Mary Lou Galantino PT, PhD, Richard Stockton College
Laura Gilchrist PT, PhD, St. Catherine University
Victoria Marchese PT, PhD, Lebanon Valley College
G. Stephen Morris PT, PhD, MD Anderson
Kiri Ness PT, PhD, St. Jude Children’s Research Hospital
Meredith Wampler PT, DPTSc, POTENTRx
Case Study—ICF Model

Health Condition
Breast Cancer

Body
↓ Range of motion
Muscle weakness
Radiation fibrosis
Lymphedema risk

Individual
Difficulty reaching
Difficulty lifting
Daily pain
Chronic fatigue

Society
Unable to play with grandchildren
Unable to tolerate clothing

Environmental
Part-time work
Travel Precautions
Housework Demands

Personal Factors
Hx Hodgkin’s
Body Image Changes
Cardiomyopathy
## Classification of Self-Report Outcome Measures

<table>
<thead>
<tr>
<th>Generic Health Status</th>
<th>Condition/Region Specific</th>
<th>Patient Specific</th>
<th>Hybrid</th>
</tr>
</thead>
</table>
| • Does not refer to a specific disease or problem  
• Taps a spectrum of health concepts  
• Permits comparison among groups with different health problems (e.g. cancer, kidney disease, OA, stroke) | • Assesses characteristic or activities most relevant to the condition or intervention | • Assesses characteristic or activities that are most relevant to the individual | • Measures a spectrum of health concepts, including physical, social and emotional  
• Characteristics of both generic health status and condition-specific |

| 36 item short form (SF-36) | Disabilities of Arm, Shoulder, & Hand (DASH) | Patient-Specific Functional Scale (PSFS) | Functional Assessment of Cancer Therapy--Breast (FACT-B) |
Rehab Specific (Global/Generic)

- PROMIS
  - National Institute of Health
  - Patient Reported Outcomes Measurement Information System
  - Global and impairment specific

- Activity Measure – Post Acute Care (AM-PAC)
  - Boston Rehabilitation Outcomes Center Network
  - Basic mobility, daily activities and applied cognitive

- Focus On Therapeutic Outcomes measure (FOTO)
  - 0-100 score
  - Prediction of goals

- OPTIMAL
  - American Physical Therapy Rehabilitation
  - 22 items easily mapped to the ICF-based
  - Centers for Medicare & Medicaid Services (CMS) recommended
Rehabilitation Measures Database

With over 400 measures and supported by some of the world's best doctors, clinicians, therapists and Physical Therapists.
Screening: Does the patient have any known cancer?

- Past medical history of cancer or current cancer diagnosis in the past year?
- Has it been more than five years that you are cancer-free?
- Is it less than 5 years since your cancer diagnosis?
- Are you considered cancer-free by your physician?
- Date of last checkup: ________________________

"I don't know what these dots are ... but ya mind if I connect 'em?"
Screening: Does the patient have any signs or symptoms of cancer?

**Change in bowel or bladder habits**

**A**sore that does not heal

**U**nusual bleeding or discharge

**T**hickening or lump in breast

**I**ndigestion or difficulty swallowing

**O**bvious change in wart or mole

**N**agging cough or hoarseness

**Additional signs/symptoms:**
- Unexplained weight loss
- Fever
- Fatigue
- Pain
- Skin changes
  - Hyperpigmentation
  - Jaundice
  - Erythema
  - Pruritis
  - Excessive hair growth
  - White patches inside the mouth or on the tongue

*Think of body systems:*
- **GI tract** (swallow, appetite, indigestion, elimination)
- **Integument** (skin changes/sores),
- **Circulatory** (bleeding), glandular (discharge),
- **Lymphatic** (swelling, nodules),
- **Respiratory** (cough, difficulty breathing)
Screening: Does the patient have any risk factors associated with cancer?

- Tobacco and Smoking: 31%
- Diet and Obesity: 31%
- Sedentary Lifestyle: 5%
- Occupational Exposure: 5%
- Family History: 5%
- Viruses: 5%
- Perinatal Factors/Growth: 5%
- Alcohol: 3%
- Socioeconomic Status: 3%
- Pollution: 2%
- UV radiation: 2%
- Drugs & Medical Procedures: 1%
- Salt, Food Additives & Contaminants: 1%
Screening:
Is the patient over 50 years of age?

Age is the greatest risk factor for cancer.

Median age at diagnosis in U.S. across all cancer types is 66 years old. 78% of all cancer diagnoses are in people 55 years of age or older.
Cancer is a GENETIC Disease

Sporadic = common > 90%
- Accumulation of mutations in somatic cells over a lifetime
- Develop at older age

Hereditary = less common 5-10%
- (But very common within affected family!)
- Inherited susceptibility via germline (egg or sperm) mutation
- Gives tumor a “head start”
- Develop at a younger age
Genetic Testing

Looks for specific inherited changes (mutations) in a person’s chromosomes, genes, or proteins.

Genetic mutations can have harmful, beneficial, neutral (no effect), or uncertain effects on health.

Harmful mutations may increase a person’s chance, or risk, of developing a disease such as cancer.

Strongly considered when all three of the following criteria are met:

- Personal or family history that suggests an inherited cancer risk condition
- The test results can be adequately interpreted
- The results provide information that will help guide a person’s future medical care
Does Cancer Run in Your Family?  
You may have increased cancer risk...

Know your family history — Know the red flags for hereditary cancer

<table>
<thead>
<tr>
<th>Red Flags for Hereditary Cancer</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Multiple Cancers</strong></td>
</tr>
<tr>
<td>A combination of cancers on the same side of the family</td>
</tr>
<tr>
<td><strong>Young Cancers</strong></td>
</tr>
<tr>
<td>Cancer at age 50 or younger in you or a family member</td>
</tr>
<tr>
<td><strong>Rare Cancers</strong></td>
</tr>
<tr>
<td>Rare cancers at any age in you or a family member</td>
</tr>
</tbody>
</table>

Certain ancestries may have greater risk for hereditary cancer syndromes (e.g., Ashkenazi Jewish ancestry).

Family members include first-, second-, and third-degree blood relatives on both your mother and father’s sides.
Oncologic Emergencies

Structural/Obstructive
- Spinal Cord Compression (SCC)
- Pericardial effusion
- Superior vena cava syndrome

Metabolic
- Hypercalcemia
- Tumor Lysis Syndrome

Hematologic
- Neutropenia
- Thrombo-embolic events
# What to Watch for in Oncologic Emergencies

<table>
<thead>
<tr>
<th>Spinal Cord Compression</th>
<th>Superior Vena Cava Syndrome</th>
<th>Malignant Pericardial Effusion</th>
<th>Neutropenia; Neutropenic Fever</th>
<th>Hypercalcemia of Malignancy</th>
<th>Tumor Lysis Syndrome</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pain—localized in area or referred, radicular</td>
<td>Initial symptoms: Facial swelling, tightness at shirt collar, ruddy complexion, periorbital and conjunctival edema</td>
<td>Dyspnea, cyanosis</td>
<td>Neutropenia with a declining absolute neutrophil count</td>
<td>Gastrointestinal: Nausea, vomiting, constipation, abdominal pain</td>
<td>Note: symptoms not usually manifested in early stages</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Nausea, vomiting</td>
</tr>
<tr>
<td>Motor deficits: loss</td>
<td>Intermediate symptoms: full feeling in arms, edema in fingers, hands, epistaxis, erythema of face, neck, upper trunk</td>
<td>Engorged neck veins, orthopnea</td>
<td>Single oral temperature of at least 38.3°C (101°F) or a temp of at least 38°C (100.4°F) for more than 1 hour.</td>
<td>Central nervous system: Confusion, progressive decline in mental function, psychosis, stupor, coma</td>
<td>Muscle weakness, arthralgia</td>
</tr>
<tr>
<td>Sensory impairment</td>
<td>Late symptoms: cardiovascular, respiratory, central nervous</td>
<td>Palpitations and fall in systolic BP of more than 10 mm Hg</td>
<td>Note: classic signs of localized infection such as pain, redness, warmth, inflammation are often absent.</td>
<td>Cardiovascular, increased heart rate, blood pressure, arrhythmias</td>
<td>Fatigue, lethargy</td>
</tr>
<tr>
<td>Autonomic dysfunction</td>
<td>Fatigue</td>
<td></td>
<td></td>
<td>Renal: dehydration, polyuria, polydipsia, renal failure</td>
<td>Dysrhythmias, seizures</td>
</tr>
</tbody>
</table>

Cloudy urine

Adapted from Morris, G.S., Brueilly, K.E., Paddision, N.V. Oncologic Emergencies, Topics in Geriatric Rehabilitation 27(3):176-183m July 2011.
Exercise Clearance (modified from Schmidt et al, 2010)

**General**

Evaluate for comorbidities

Exercise testing is not generally required for walking, flexibility and weight training

If exercise testing is needed for higher level aerobic activity then follow ACSM for testing and contraindications


**Specific**

**Colon**
- Evaluate ostomy self-care

**Breast**
- Evaluate the arm/shoulder
- Lymphedema risk

**Prostate**
- Evaluate pelvic girdle
- Lymphedema risk

**Gyn**
- Evaluate pelvic girdle
- Lymphedema risk

**Lung**
- Evaluate pulmonary function
Precautions and Contraindications Specific to Patients with Cancer

Monitoring physiologic responses (e.g., vital signs) to exercise is important in the immunosuppressed population.

The Rate of Perceived Exertion (RPE) should not exceed 5 to 7 for moderate intensity training or submaximal testing.

Notify physician regarding abnormal responses to exercise

Activity level of a patient with anemia may require adjustments in exercise intensity and duration
Oxygen Blood Levels

Know your patient’s baseline

Normal is between 95-100%

Normal response 2-3% drop with exercise
  ◦ Stay above 92% (normal population recommendation)

Below 90% is considered hypoxemia
  ◦ Temporary hypoxemia due to exercise
  ◦ Hypoxemia can transition to hypoxia
  ◦ Some patients may need supplementation (could be temporary need)

Photo Credit pulse image by JASON WINTER from Fotolia.com

Read more: http://www.livestrong.com/article/278796-oxygen-saturation-exercise/#ixzz28GdwY1ZS
Rate of Perceived Exertion Scale

How do you feel when you are exercising?

How much effort are you using?
Determining Aerobic Exercise Intensity

Karvonen Formula

Training Heart Rate = 
(desired intensity range)(HR max – HR rest) + HR rest

Healthy Individual:
(60% to 90%)(119) + 48 = 120 to 155 Training HR

Cancer Patient:
(40% to 60%)(77) + 90 = 128 to 137 Training HR
## Exercise Precautions and Contraindications

<table>
<thead>
<tr>
<th>LAB VALUES/EXERCISE PARAMETERS</th>
<th>Normal Values/Units</th>
<th>Symptom Based Approach</th>
<th>Light Exercise (light aerobic)</th>
<th>Regular Exercise</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hematocrit</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Females</td>
<td>37% to 47%</td>
<td>&lt; 25%</td>
<td>&gt;25-30%</td>
<td></td>
</tr>
<tr>
<td>Males</td>
<td>40% to 50%</td>
<td></td>
<td></td>
<td>&gt;25% &gt; 30%</td>
</tr>
<tr>
<td>Hemoglobin</td>
<td>12—16 g/dl</td>
<td>&lt; 8 g/dl</td>
<td>8—10 g/dl</td>
<td>&gt;10 g/dl</td>
</tr>
<tr>
<td>Females</td>
<td>14—18 g/dl</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Males</td>
<td>12—16 g/dl</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>White Blood Cells</td>
<td>4,500 to 11,000</td>
<td>&lt;5,000, evaluate for risk of infection &lt;3,000 no exercise</td>
<td>&gt;5,000</td>
<td>&gt;5,000</td>
</tr>
<tr>
<td>Platelets</td>
<td>150,000 to 450,000</td>
<td>&lt;10,000</td>
<td>10,000-20,000</td>
<td>&gt;20,000 &gt;50,000 resistance</td>
</tr>
</tbody>
</table>

- Always consider symptoms, beware severe neutropenia
- Relative values – advanced centers may have more liberal practice patterns; Evidence is quickly overturning these beliefs

(Humpel & Iverson, 2005; APTA Taskforce on Lab Values 2017)
Exercise Prescription: What is the Goal?

Oddvar Holten Diagram

- 100% (1 Rep.)
- 95%
- 90%
- 85%
- 80%
- 75%
- 70%
- 65%
- 60%
- R.M.
- 4 Strength
- 16 Strength/Endurance
- 22
- 25 Endurance
- 30
Submaximal Clinical Exercise Tolerance Tests

Modified Naughton Treadmill Test

NuStep Submaximal Exercise Test
  ◦ https://www.youtube.com/watch?v=wZe9TJQVc1Q

6 Minute Walk Test
Timed Up and Go
Timed Sit to Stand Test
Lymphatic Failure

Dynamic (edema)
- Transport capacity = normal
- Lymphatic load = increased

Mechanical (lymphedema)
- Transport capacity = decreased
- Lymphatic load = normal

Combination (lymphedema)
- Transport capacity = decreased
- Lymphatic load = increased

Hemodynamic (cardiac edema)
- Transport capacity = normal/decreased
- Lymphatic load = increased due to right ventricular failure
Main Functions of Lymphatic System

**Immunological**
- Make WBCs
- Filter foreign bodies
  - ✓ Cancer cells
  - ✓ Bacteria
  - ✓ Viruses

**Fluid balance**
- Remove proteins from interstitium
- Filter and concentrate fluid
- Transport clean fluids back to the blood
- Transports fats from digestive system
Lymphedema Characteristics

Unilateral, normally**
Asymmetrical
Firm, springy edema
Pitting – Stage 1 only
Foot/hand involved
Frequent cellulitis
Pale skin color
Stemmers positive, normally
Ulcerations

Progressive, lifelong disease without treatment
Lymphedema of the Limbs
Signs and Symptoms of Arm or Leg Lymphedema

- Feeling of tightness, fullness, tingling, or heaviness
- Rings, watch, or bracelet become tight
- Shoes or socks become tight
- May swell during the day and diminish or disappear overnight
- Decreased visibility of the veins in the dorsum of hand
- Greater roundness or fullness of the elbow, wrist or forearm
- Foot “hump”
- Swelling of fingers or toes
Truncal and Breast Lymphedema
Common Symptoms of Trunk/Breast Lymphedema

- **Trunk**
  - Vise-like pressure around the lower rib cage or thorax
  - Waistband on clothing feels tighter at the end of the day

- **Breast**
  - Feeling of fullness, tenderness, pain, heat in the breast tissue
  - Vise-like pressure around the chest or thorax
  - Bra feels tighter and more uncomfortable and the end of the day
Pelvic/Genital Lymphedema
Facial and Neck Lymphedema
Measurement Tools

Volume
- Gold standard – water displacement

Circumferential
- Fixed distances from the middle finger or anatomical landmarks
- Use truncated cone formula to calculate volume
  \[ V = h\left(\frac{C_1^2 + C_1C_2 + C_2^2}{12}\right) \]

Don’t underestimate the consumer’s reports of firmness or tightness
- Correlated with circumferential and bioimpedance measurements of edema (Ridner et al, 2007)


Other Measurement Tools

Bioimpedance
- Measures the resistance to the flow of an electrical current in the tissues
- Greater sensitivity and specificity in detecting changes but lacks location details and significant within subject variability
- Cornish showed the ability to identify subclinical lymphedema 10 months before clinical presentation (Lymphology. 2001 Mar;34(1):2-11)

Perometry
- Infrared opto-electric volumetry used for upper and lower extremity edema (Moseley, Lymphology. 2002 Dec;35(4):136-43)
- Doesn’t measure hands or feet well
Perometry

http://joycebosman.waaronlijn.nu/reisverslag/2984288/heidi-is-out-back

http://www.sanitaetshaus-liebe.de/HTML/a0802/a0802.htm
Stemmers Sign

Attempting to tent the skin at the base of the second toe or finger

Positive – if unable to lift the skin
  ◦ Sensitivity is good

False negative is possible
  ◦ Specificity is poor

Lawenda et al, CA Cancer J Clin 2009; 59:8-24
Tiwari A et al, Arch Surg 2003; 138: 152-61
Differential Diagnosis
Cardiac Edema

Bilateral
Symmetric
Soft edema
Quick refill with pitting attempt
Elevation effective
Discoloration, occasionally
Hx of CHF
Stemmer’s negative
Differential Diagnosis
Dependent Edema

Bilateral
Symmetrical involvement
Pitting
Foot involvement
Stemmer negative
Soft edema
Typically no ulcerations
Elevation effective
Differential Diagnosis
Lipedema

Bilateral
Primarily affects females
Associated with obesity
Symmetrical
Soft edema
Painful
Minimal pitting
Elevation ineffective
Stemmer negative
Absence of foot swelling
Differential Diagnosis
Primary Lymphedema

Congenital Lymphedema
- Milroy’s Disease
  - Swelling in one or both legs, begins at birth/infancy

Lymphedema Praecox
- Meige’s Disease
  - Most common, occurs at puberty or during pregnancy

Tarda
- Late onset
  - Rare, usually begins after age 35

Transport capacity abnormal
- Lymph node
- Lymph vessel formation
- Hypoplasia (fewer and smaller)
Differential Diagnosis

Primary Lymphedema

Klippel-Trenaunay-Weber Syndrome
- Port wine staining--capillary vascular malformation
- Venous (tortuous veins)
- Lymphatic (vessels on the surface and lymphedema)

Parkes Weber syndrome
- Hemangiectatic hypertrophy (severe)
Lymphedema Staging

Stage 0
- Brief swelling in hand
- Subclinical
- 3% volume change

Stage 1 (Reversible)
- Edema
- Soft
- Pitting
- No pain
- 2-cm or greater difference in limb girth, a 200-ml or greater difference in limb volume, or a 10% or greater difference in limb volume

Stage 2 (Spontaneously Irreversible)
- Edema
- Fibrotic changes, difficult to pit
  - Measure with tonometer
- Can reduce edema to normal
- Can soften filaments, but not reverse fibrosis
- May have pain

Stage 3 (Irreversible)
- Severe edema
- Fibrosis
- No pitting, too much fibrosis
- Pain and skin discoloration

Stage 1
Stage 2
Stage 3
What Causes Chemotherapy-Induced Peripheral Neuropathy?

Neurotoxic chemotherapeutic agents

Length dependent, meaning fibers furthest from the trunk are affected first

Dose-dependent

Worse when neurotoxic drugs are given in combination or in succession

Risk factors include baseline peripheral neuropathy, diabetes, older age

79
### Agents Known to Cause Neuropathy

<table>
<thead>
<tr>
<th>Platinum-based agents</th>
<th>Taxanes</th>
<th>Vinca alkaloids</th>
<th>Other Agents</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cisplatin</td>
<td>Taxol</td>
<td>Vincristine</td>
<td>Epothilones</td>
</tr>
<tr>
<td>Carboplatin</td>
<td>Taxotere</td>
<td>Vinblastine</td>
<td>Velcade</td>
</tr>
<tr>
<td>Oxaliplatin</td>
<td></td>
<td></td>
<td>Thalidomide</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Lenolidamide</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Methotrexate</td>
</tr>
</tbody>
</table>

- **Platinum-based agents**
  - Cisplatin
  - Carboplatin
  - Oxaliplatin
  - **Mild to moderate numbness and tingling of hands and feet**
  - Reduced or absent Achilles tendon reflex
  - Ototoxicity
  - Perioral dysthesias

- **Taxanes**
  - Taxol
  - Taxotere
  - **Mild to moderate numbness, tingling, burning/stabbing pain of hands and feet**
  - Reduced or absent Achilles tendon reflex
  - Weakness of distal muscles with high doses

- **Vinca alkaloids**
  - Vincristine
  - Vinblastine
  - **Mild to moderate numbness, tingling, burning/stabbing pain of hands and feet**
  - Reduced or absent Achilles tendon reflex
  - Weakness of distal muscles, foot drop with high doses

- **Other Agents**
  - Epothilones
  - Velcade
  - Thalidomide
  - Lenolidamide
  - Methotrexate
Clinical Measures for CIPN

<table>
<thead>
<tr>
<th>NTX – 12</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Please circle the number that indicates how true each statement has been for you during the past 7 days.</strong></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Not at all</td>
</tr>
<tr>
<td>have numbness or tingling in my hands.</td>
<td>0</td>
</tr>
<tr>
<td>have numbness or tingling in my feet.</td>
<td>0</td>
</tr>
<tr>
<td>feel discomfort in my hands.</td>
<td>0</td>
</tr>
<tr>
<td>feel discomfort in my feet.</td>
<td>0</td>
</tr>
<tr>
<td>have joint pain or muscle cramps.</td>
<td>0</td>
</tr>
<tr>
<td>feel weak all over.</td>
<td>0</td>
</tr>
<tr>
<td>have trouble hearing.</td>
<td>0</td>
</tr>
<tr>
<td>get a ringing or buzzing in my ears.</td>
<td>0</td>
</tr>
<tr>
<td>have trouble buttoning buttons.</td>
<td>0</td>
</tr>
<tr>
<td>have trouble feeling the shape of small objects when they are in my hand.</td>
<td>0</td>
</tr>
<tr>
<td>have trouble walking.</td>
<td>0</td>
</tr>
<tr>
<td>have pain in my hands or feet when I m exposed to cold temperatures.</td>
<td>0</td>
</tr>
</tbody>
</table>

Total __________(0 to 48)

Kopec et al. 2006, Validation of a self-reported neurotoxicity scale in patients with operable colon cancer receiving oxaliplatin. Journal of Supportive Oncology, Volume 4, No 8
Clinical Measures for CIPN

Achilles tendon reflexes
Monofilament testing of hands and feet
Vibration sense using tuning fork
Manual muscle testing
Gait and balance assessment
Hand dexterity tests
### Interventions for CIPN

<table>
<thead>
<tr>
<th>Sensory</th>
<th>Function</th>
<th>Balance</th>
<th>Safety</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sensory balls</td>
<td>Nordic Pole Walking</td>
<td>Wii-habilitation</td>
<td>Adaptive equipment</td>
</tr>
<tr>
<td>Theraputty</td>
<td>Pedometer Monitored Walking</td>
<td>Core exercise</td>
<td>Home modification</td>
</tr>
<tr>
<td>Kinesiotape</td>
<td>Brain Bike</td>
<td>Stability ball training</td>
<td></td>
</tr>
<tr>
<td>Tactile Walking Paths</td>
<td>Hand dexterity</td>
<td>Varied surface training</td>
<td></td>
</tr>
<tr>
<td>Gloves</td>
<td>Strength training</td>
<td>Vestibular training</td>
<td></td>
</tr>
<tr>
<td>Massage</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Low level laser</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Interventions for CIPN
Wii-habilitation
Compression for CIPN
Chemical Burn
Chemotherapy-Induced Cognitive Impairment (CICI)

“Chemo brain”, “Chemo fog”

Defined as impairment of patient’s

- Memory
- Learning
- Concentration
- Reasoning
- Executive function
- Attention
- Visual-spatial skills
  - During and after discontinuation of chemotherapy
Patient Experiences

“I have been so lost (while driving), I just pull over, and break down and start crying. Because it’s places I’ve been before and I know where I am going…”

“I couldn’t remember if I looked at a stoplight. I felt like it was putting myself at risk.”

“What I have to do sometimes is have my son come over and pay my bills.”

Boykoff et al, J Cancer Surviv, 2009
Proposed Mechanisms

Direct toxic effects
Apoptosis effects of some neurons
Impaired neuroplasticity and neurogenesis capacity
Impaired neurotransmitter release and uptake
Restricting blood flow in the brain or interfering with chemical signaling
A proposed mechanism for chemotherapy-related cognitive impairment (‘chemo-fog’)

Oxidative stress
Mitochondrial dysfunction

Chemofog

TNF-α
Risk Factors for CICI

Radiation to the brain
Higher does of chemo or radiation
Multi-agent chemo combined with radiation
Brain cancer
Chemo combined with whole brain radiation
Chemo therapy given directly to the CNS
Hormone changes or treatments
Immune related dysfunction
Genetic predisposition for genes associated with Alzheimer’s
The cancer itself

Tiredness (fatigue)
Sleep problems
Other illness, such as DM or HTN
Drugs such as steroids, anti-nausea, or anesthesia, pain medications
Depression
Low blood counts
Age
Infection
Nutritional deficiencies
Stress, anxiety, worry, or other emotional pressure
Younger age at time of cancer diagnosis and treatment
Chemotherapy Medications Commonly Associated with CICI

<table>
<thead>
<tr>
<th>Medication</th>
<th>Risk Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Adriamycin</td>
<td>These medications carry an increased risk of CICI by damaging neural progenitor cells.</td>
</tr>
<tr>
<td>Cyclophosphamide</td>
<td></td>
</tr>
<tr>
<td>Methotrexate</td>
<td></td>
</tr>
<tr>
<td>5-Fluorouracil</td>
<td>Risk escalates with increased dose and length of exposure.</td>
</tr>
<tr>
<td>Cisplatin</td>
<td></td>
</tr>
<tr>
<td>BCNU</td>
<td></td>
</tr>
<tr>
<td>Cytarabine</td>
<td></td>
</tr>
</tbody>
</table>
Cognitive Screening

Systems review
- Ability to make needs known
- Consciousness
- Orientation (person, place, and time)
- Expected emotional/behavioral responses
- Learning preferences (barriers, education needs)

Evidence Based Measurement
- Functional Assessment of Cancer Therapy-Cognition (FACT-COG)
- High Sensitivity Cognitive Screen (HSCS)
- Mini Mental State Exam (MMSE)
- Trail Making Test
- Stroop Color Word Test
- Montreal Cognitive Assessment (MoCA)
Rehab Interventions for CICI

Exercise
- Physical activity increases cognitive health and quality of life for those on chemotherapy
- Brain-training programs
  - Brainhq.com
  - Graded motor imagery—Recognize App
  - Dual task training—pole walking, WiiFit

Cognitive Strategies
- Memory aides
- Written HEP or educational materials with pictures/photos
- Videotape home exercise program for survivors who prefer to use a computer to follow their exercise program
  Example: MedBridge HEP

Referral to neurologists, psychologists, neuropsychologists, occupational therapists, speech language pathologists
Cancer Pain

Pain is a complex symptom that affects most aspects of life
  ◦ Physical functioning
  ◦ Daily activity
  ◦ Psychological and emotional status
  ◦ Social life

Substantial diversity in cancer pain experience and appearance

The constellation of symptoms and signs may suggest a specific cancer pain syndrome
Types of Pain—Onset and Duration

Acute pain syndromes have a sudden, well-defined onset, an identifiable cause (e.g. surgery), subject to sympathetic output (fight or flight response), and are expected to improve with management.

Chronic pain on the other hand, has a less distinct onset, has a prolonged and fluctuating course, and is largely driven by central sensitization and neuroplastic responses from acute injury.

Breakthrough pain is characterized by intermittent “pain flares”.
Types of Pain—Location

- Somatic
- Visceral
- Neuropathic
# Common Causes of Pain in Cancer Patients

<table>
<thead>
<tr>
<th>Malignancy-Related</th>
<th>Antineoplastic therapies</th>
<th>Other comorbidities</th>
</tr>
</thead>
<tbody>
<tr>
<td>• bone metastases</td>
<td>• side effects from</td>
<td>• immobility</td>
</tr>
<tr>
<td>• soft tissue</td>
<td>chemotherapy, immunotherapy, hormonal therapy, and radiation therapy</td>
<td>• constipation</td>
</tr>
<tr>
<td>metastases</td>
<td>• post-procedural and post-surgical pain</td>
<td>• thrombophlebitis</td>
</tr>
<tr>
<td>• visceral</td>
<td></td>
<td>• unaddressed</td>
</tr>
<tr>
<td>metastases</td>
<td></td>
<td>psychosocial and</td>
</tr>
<tr>
<td>• leptomeningeal</td>
<td></td>
<td>psychiatric issues</td>
</tr>
<tr>
<td>metastases</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• epidural spinal</td>
<td></td>
<td></td>
</tr>
<tr>
<td>cord compression</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• malignant bowel</td>
<td></td>
<td></td>
</tr>
<tr>
<td>obstruction</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• pathologic fracture</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• hemorrhage into</td>
<td></td>
<td></td>
</tr>
<tr>
<td>a tumor</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• tumor-related</td>
<td></td>
<td></td>
</tr>
<tr>
<td>neuropathic pain</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Cancer Pain: Bone Metastases

Pain
- Often the first symptom of cancer that has spread to the bone
- Pain may come and go at first
- Initially worse at night and may get better with movement
- Later it can become constant and may be worse during activity

Fractures
- Most common in the long bones of the arms and legs and the vertebrae.
- Example: Sudden pain in the middle of the back is a common symptom of a bone in the spine breaking and collapsing from cancer.
Cancer Pain: Bone Metastases

Spinal cord compression
- Pain in the back or neck
- Pressure on the spinal cord can damage the nerves
- Numbness, weakness, paralysis
- Difficulty urinating
- Constipation

Hypercalcemia
- Calcium from the bones can be released into the bloodstream
- Constipation, nausea, loss of appetite, excessive thirst, frequent urination, dehydration
- Coma
Bone Metastases—Acute

Pathologic fracture
- Bone fracture that occurs within a pre-existing lesion
- Skeletal metastases or primary bone tumor
- Sudden onset of back or limb pain without trauma
- Surgical stabilization of long bones
- Vertebral surgeries rare and used typically to treat neurological symptoms
- Radiation therapy usually considered
Bone Metastases—Chronic

Multifocal bone pain—most prevalent cause

Direct invasion, secondary pathologic fracture, or damage to adjacent structures

Factors thought to convert a painless to a painful bone metastasis
  ◦ Combination of direct nociceptor activation by tumor
  ◦ Mechanical distortion related to microfracture
  ◦ Local release of growth factors and/or chemical mediators

Local field external beam radiation therapy is effective modality
  ◦ Pain relief seen in 80 to 90 % of cases
Multifocal Bone Metastases

Nuclear medicine bone scan showing multiple bones metastases (black areas)
Uncoupled Regulation of Osteoblasts and Osteoclasts Leads to Bone Malformation

<table>
<thead>
<tr>
<th>Osteoblastic</th>
<th>Osteolytic</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Osteoblasts form new bone</td>
<td>• Osteoclasts dissolve old bone</td>
</tr>
<tr>
<td>• Cancer cells release substances that turn on the osteoblasts</td>
<td>• Cancer cells make substances that turn on the osteoclasts</td>
</tr>
<tr>
<td>• New bone is formed without breaking down the old bone</td>
<td>• Bone is broken down without new bone forming</td>
</tr>
<tr>
<td>• Areas of the bones become harder, a condition called sclerosis</td>
<td>• Holes or osteolytic lesions develop when parts of bones dissolve</td>
</tr>
<tr>
<td>• Osteoblastic lesions are harder but structure of the bone is not normal and actually breaks more easily</td>
<td>• Osteolytic lesions are so weak that they can cause the bone to easily break</td>
</tr>
</tbody>
</table>

Malformed bones may also mechanically trigger pain receptors both within the bone and in the surrounding tissues.
## Primary Bone Response to Tumors

<table>
<thead>
<tr>
<th>Predominantly Osteoblastic</th>
<th>Predominantly Osteolytic</th>
<th>Mixed Osteoblastic and Osteolytic</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Prostate cancer</td>
<td>• Renal cell cancer</td>
<td>• Breast cancer</td>
</tr>
<tr>
<td>• Carcinoid</td>
<td>• Melanoma</td>
<td>• Gastrointestinal cancers</td>
</tr>
<tr>
<td>• Gastrinoma</td>
<td>• Squamous cell cancers</td>
<td>• Squamous cancers at most</td>
</tr>
<tr>
<td>• Small cell lung cancer</td>
<td>• of the aerodigestive</td>
<td>primary sites</td>
</tr>
<tr>
<td>• Hodgkin’s disease</td>
<td>tract</td>
<td></td>
</tr>
<tr>
<td>• Medulloblastoma</td>
<td>• Non-small cell</td>
<td></td>
</tr>
<tr>
<td></td>
<td>lung cancer</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Thyroid cancer</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Non Hodgkins</td>
<td></td>
</tr>
<tr>
<td></td>
<td>lymphoma</td>
<td></td>
</tr>
</tbody>
</table>
Cancer Pain: Tissue Adhesions

The adherence between muscles, subcutaneous tissue, and the skin

Ascribed to the surgical trauma and scarring caused by dissection

Influenced by the fibrosing effects of adjuvant radiation therapy

Lauridsen et al, 2005
Tissue Adhesions
The Fatigue Experience

Rate your fatigue level right now on a scale of 1 to 10:

0 1 2 3 4 5 6 7 8 9 10

No fatigue

Draw a picture or write a sentence or phrase about how your fatigue feels.

I would, if I could, but I can’t, so I won’t.
Fatigue Screening

Rate your fatigue level **right now** on a scale of 1 to 10:

- No Fatigue
- Worst Fatigue Imaginable

Draw a picture or write a sentence or phrase about how your fatigue feels.
Clinical Tool: Qualitative Descriptors

- Rate your fatigue level **right now** on a scale of 1 to 10:

<table>
<thead>
<tr>
<th>No Fatigue</th>
<th>0</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
<th>10</th>
</tr>
</thead>
<tbody>
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</tr>
</tbody>
</table>

- Draw a picture or write a sentence or phrase about how your fatigue feels.

- Rate your fatigue level **right now** on a scale of 1 to 10:

<table>
<thead>
<tr>
<th>No Fatigue</th>
<th>0</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
<th>10</th>
</tr>
</thead>
<tbody>
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</tr>
</tbody>
</table>

- Draw a picture or write a sentence or phrase about how your fatigue feels.
What is Fatigue?

Definition
- Feeling tired physically, mentally and emotionally
- Having less energy to do the things you normally do or want to do

Normal response to
- Physical exertion
- Emotional stress
- Boredom
- Lack of sleep

Abnormal response when not relieved by
- Enough sleep
- Good nutrition
- A low-stress environment
Components of Fatigue

- **Behavior**: Effects on performance
- **Feeling**: Subjective experience
- **Mechanism**: Physiological, Psychological
- **Context**: Environment, Attitudes

Fatigue Symptom Clusters

- Pain
- Anemia
- Immobility
- Comorbidity
- Distress
- Infection
- Sleep disturbance
- Poor nutrition
- Fatigue
Sleep Quality

Tiredness
- Normal sleep pattern
  - Able to respond to sleepiness
  - Feel rested after sleep

Fatigue
- Chronic disrupted sleep pattern
  - Often require sleeping pills
  - Do not feel rested after sleep

Exhaustion
- Erratic sleep pattern
  - Periods of too much or too little sleep
  - Absence of circadian rhythm
Cognition

Tiredness
- Forgetful
- Somatic symptoms i.e., headache

Fatigue
- Inability to concentrate
- Belief that exercise or exertion will worsen fatigue

Exhaustion
- Confusion or “brain fog”
  - Inability to find way home from familiar places
  - Unable to keep track of appointments
  - Dependency for daily needs that require memory or concentration
Stamina

**Tiredness**
- Gradual loss of energy in proportion to energy expended
- Restored by rest

**Fatigue**
- Gradual loss of energy (not increased weakness) out of proportion to energy expended
- Repeated experience may lead to decreased activity

**Exhaustion**
- Sudden and unexpected loss of energy out of proportion to energy expended
- Deconditioning limits activities of daily living
Emotional Reactivity

Tiredness
- Impatience

Fatigue
- Uncharacteristic anxiety
- Tearfulness

Exhaustion
- Emotional numbness
- May proceed without the individual perceiving a change
Control over Body Processes

**Tiredness**
- Body and mind work together

**Fatigue**
- Mind over body
  - Must “force” themselves to continue
  - Increased sensitivity to light, noise, touch, and taste
  - Feeling cold
  - Being off balance
  - Increased nausea and diarrhea

**Exhaustion**
- Body over mind
  - Overwhelming need to lie down
  - Numbness in some body parts
  - State their bodies feel unfamiliar to them
Social Interaction

- **Tiredness**: Engages in normal social activities
- **Fatigue**: Saves energy for participation in enjoyable activities
- **Exhaustion**: Withdraws from all social activities; withdrawal may be reinforced by others

- Work-related problems
How Do We Measure Fatigue?

**Brief Fatigue Inventory (BFI)**
(Mendoza et al. 1999; Radbruch et al. 2003, Okuyama et al. 2003)

<table>
<thead>
<tr>
<th>Type of Measure</th>
<th>Characteristics</th>
<th>Reliability and Validity</th>
</tr>
</thead>
</table>
| Free-standing, unidimensional fatigue measure | Severity and impact of fatigue  
Now and during the past 24 hours  
General activity, mood, walking ability, normal work, relationships, and overall enjoyment of life | Reliability: internal consistency $\alpha = 0.96$  
Concurrent validity: correlated with  
FACT ($r = -0.88$)  
POMS ($r = 0.84$) |
| 9-item 0-10 numeric rating scale | | |
| Short and easy to use | | |
| Useful with a filter question to screen for presence of CRF | | |
Brief Fatigue Inventory

Copyright 1997
The University of Texas M.D. Anderson Cancer Center.
All rights reserved.
# How Do We Measure Fatigue?

## Multidimensional Fatigue Symptom Inventory Short Form (MFSI-SF)

Stein et al. 1998

<table>
<thead>
<tr>
<th>Type of Measure</th>
<th>Characteristics</th>
<th>Reliability and Validity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Free-standing, multidimensional fatigue measure</td>
<td>5 dimensions of fatigue in the past 7 days</td>
<td>Reliability: α = 0.85 – 0.96</td>
</tr>
<tr>
<td>30-item 0-4 scale</td>
<td>• General</td>
<td>Concurrent validity: Moderate to high correlations with</td>
</tr>
<tr>
<td>Short and easy to use</td>
<td>• Physical</td>
<td>• POMS (r = 0.84)</td>
</tr>
<tr>
<td>Useful with a filter question to screen for presence of CRF</td>
<td>• Emotional</td>
<td>• SF-36</td>
</tr>
<tr>
<td></td>
<td>• Mental</td>
<td>• Validated by cancer patients</td>
</tr>
<tr>
<td></td>
<td>• Vigor</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Does not assume the presence of fatigue or chronic disease</td>
<td></td>
</tr>
</tbody>
</table>

---

Stein et al. 1998
Below is a list of statements that describe how people sometimes feel. Please read each item carefully, then circle the one number next to each item which best describes how true each statement has been for you in the past 7 days.

<table>
<thead>
<tr>
<th></th>
<th>Statement</th>
<th>0</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>I have trouble remembering things</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>My muscles ache</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>I feel upset</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>4</td>
<td>My legs feel weak</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>I feel cheerful</td>
<td></td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>6</td>
<td>My head feels heavy</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>7</td>
<td>I feel cheerful</td>
<td></td>
<td></td>
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<tr>
<td>8</td>
<td>I feel nervous</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>9</td>
<td>I feel relaxed</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>I feel pooped</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>11</td>
<td>I am confused</td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>12</td>
<td>I am worn out</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>13</td>
<td>I feel sad</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>14</td>
<td>I feel fatigued</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>15</td>
<td>I have trouble paying attention</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>16</td>
<td>My arms feel weak</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>17</td>
<td>I feel sluggish</td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>18</td>
<td>I feel rundown</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>19</td>
<td>I ache all over</td>
<td></td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>20</td>
<td>I am unable to concentrate</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>21</td>
<td>I feel depressed</td>
<td></td>
<td></td>
<td></td>
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<td></td>
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<tr>
<td>22</td>
<td>I feel refreshed</td>
<td></td>
<td></td>
<td></td>
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<td></td>
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<tr>
<td>23</td>
<td>I feel tense</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>24</td>
<td>I feel energetic</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>25</td>
<td>I make more mistakes than usual</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>26</td>
<td>My body feels heavy all over</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>27</td>
<td>I am forgetful</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>28</td>
<td>I feel tired</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>29</td>
<td>I feel calm</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>30</td>
<td>I am distressed</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Measuring Fatigue ↔ Measuring Function

Measuring Fatigue:
- Brief Fatigue Inventory
- Multidimensional Fatigue Symptom Inventory—Short Form
- FACT (Functional Assessment of Cancer Therapy)
- FACIT Fatigue Scale

Measuring Function:
- 6 Minute Walk Test
- LEFS (Lower Extremity Functional Scale)
- NXT-12 (Neurotoxicity Scale
- SPPB (Short Physical Performance Battery)
- Timed Up and Go
- Functional Reach
- DASH (Disability of Arm, Shoulder, and Hand)
- SPADI (Shoulder Pain and Disability)
- MoCA
- Trail Making
- Lymphedema Life Impact Scale
Exercise and Cancer

2017 Meta-analysis JAMA Oncology

- 113 studies assessing cancer-related fatigue as the primary outcome measure
- Compared 4 most commonly recommended treatments for CRF
  - Exercise
  - Psychological
  - Combined exercise and psychological
  - Pharmaceutical

Conclusions

- Exercise and psychological interventions are effective for reducing cancer-related fatigue during and after cancer treatment, and are significant better than pharmaceutical options
- Physical therapists should prescribe exercise as a first-line treatment for cancer-related fatigue

Exercise and Cancer

2017 systematic review Epidemiologic Reviews

- 100 studies assessing exercise behavior of patients following the diagnosis of any type of cancer
- Findings show patients who exercise
  - Lower relative risk of cancer mortality and recurrence
  - Fewer/less severe adverse side effects
- Conclusion
  - Moderate to vigorous intensity aerobic and resistance exercise is an important adjunct therapy during and after cancer treatment
  - Beneficial impact on disease and patient outcomes

How Exercise Improves Fatigue

- ↑ red blood cell production
- ↑ cardiovascular function
- ↑ oxygen efficiency of muscles
- ↑ muscle fiber quantity and strength
- ↑ functional reserve of organ systems

Regulates appetite
Improves sleep quality
- ↑ feeling of well-being
- ↑ quality of life

↓ Properly prescribed exercise breaks the cycle of fatigue
Treat the Person, Not the Cancer
Competent Assessment

Select Meaningful Measures

- Valid and reliable tests/measures
- Clinically important outcomes
- Responsive to change

APTA EDGE Taskforce (Evaluation Database to Guide Effectiveness)

- Core set of tests/measures for each practice area
- Dynamic process, therefore, core sets may change over time
- Clinicians/researchers may choose to include additional evaluation/outcome measures beyond those in the recommended core set
Oncology Section EDGE Ratings of Clinical Outcome Measures

(Measures Reviewed as of 2/2016)

<table>
<thead>
<tr>
<th>Oncology Section EDGE Rating Scale</th>
</tr>
</thead>
<tbody>
<tr>
<td>(4) Highly Recommended; outcome measure has good psychometric properties.</td>
</tr>
<tr>
<td>(3) Recommended; outcome measure has good psychometric properties.</td>
</tr>
<tr>
<td>(2A) Unable to recommend due to insufficient information to support outcome measure. The measure has been used in research on individuals with cancer.</td>
</tr>
<tr>
<td>(2B) Unable to recommend due to insufficient information to support outcome measure. No published evidence that the measure has been applied to research on individuals with or post-cancer.</td>
</tr>
<tr>
<td>(1) Do not recommend</td>
</tr>
</tbody>
</table>

(Presented at CSM and published in Rehabilitation Oncology (RO) journal, Oncology Section, APTA, http://journals.lww.com/rehabonc/Pages/collections.aspx?collection=Topical)
APTA Oncology Section
Resources

www.oncologypt.org

- Lymphedema SIG
- Palliative SIG
- Pediatric SIG
- Hospice/HIV SIG

Fact Sheets

Oncology Specialization Exam--2019
To Summarize......
Clinical Lesson #1: Life is Complicated
Clinical Lesson #2: One Size Does Not Fit All
Clinical Lesson #3: Find the Motivating Factor

Small daily improvements are the key to staggering long-term results.
“There is only one cardinal rule: One must always listen to the patient.”

--Oliver Sacks

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501-852-0903