# Aquatic Therapy as a Component of Comprehensive Oncological Rehabilitation

Holly Lookabaugh-Deur, PT, DSc, CES, GCS
Board Certified; Oncology Physical Therapist
Certified Exercise Expert for Aging Adults
Muskegon, MI

# Welcome and Brief Introduction

My professional background

Motivations

Disclosures

# Learning Objectives

## Describe

- Describe the demographics of the underserved oncological rehab population, as well as barriers to care and opportunities for impact

## Identify

- Identify general, oncological rehabilitation considerations during and immediately following primary cancer treatment approaches:  chemotherapy, radiation, and surgery

## List and describe

- List and describe the most common adverse effects of cancer treatments impacting function

## Apply

- Apply fundamentals of the physiological effects of immersion with peri- and post- chemotherapy, radiation therapy and surgical patients

# More Learning Objectives

## Describe

- Describe the current evidence related to treatment of side effects of cancer treatment and aquatic therapy

## Identify

- Identify red, yellow, and green flags for the aquatic therapist working with the oncological patient

## Review

- Review (briefly) 2 articles that support aquatic therapy (preferred to land-based interventions)

## Suggest

- Suggest aquatic therapy guidelines to assist PT/PTAs in safe, effective practice with oncological patients founded on both aquatic and oncological safety

# What's Our "Why?"

There are an estimated **20+ M cancer survivors** in the United States (2025), with up to 75% of this group, challenged by persistent, adverse effects of cancer or its treatments. **Only 1 –2 % of the 18M will receive rehabilitation.**

Every cancer journey is different; surveillance in survivorship for latent adverse effects is important and often missed.

Entry level physical therapy education is now required to include oncological rehab curriculum.

The average PT DPT program provides 2 hrs of Oncology –Specific Rehab. Most PT programs also contain very little aquatic curriculum. (less than 2 hrs)

# Defining the Problem: An Underserved Population

Oncological Rehab Clinical Practice Guidelines are evolving; still a long way to go

Oncological Rehab practice is not mainstream yet– for referral sources, for practicing therapists and for the consumer

Limited number of oncology rehab specialists; residencies and specialized training

Misperceptions about what oncology rehab is

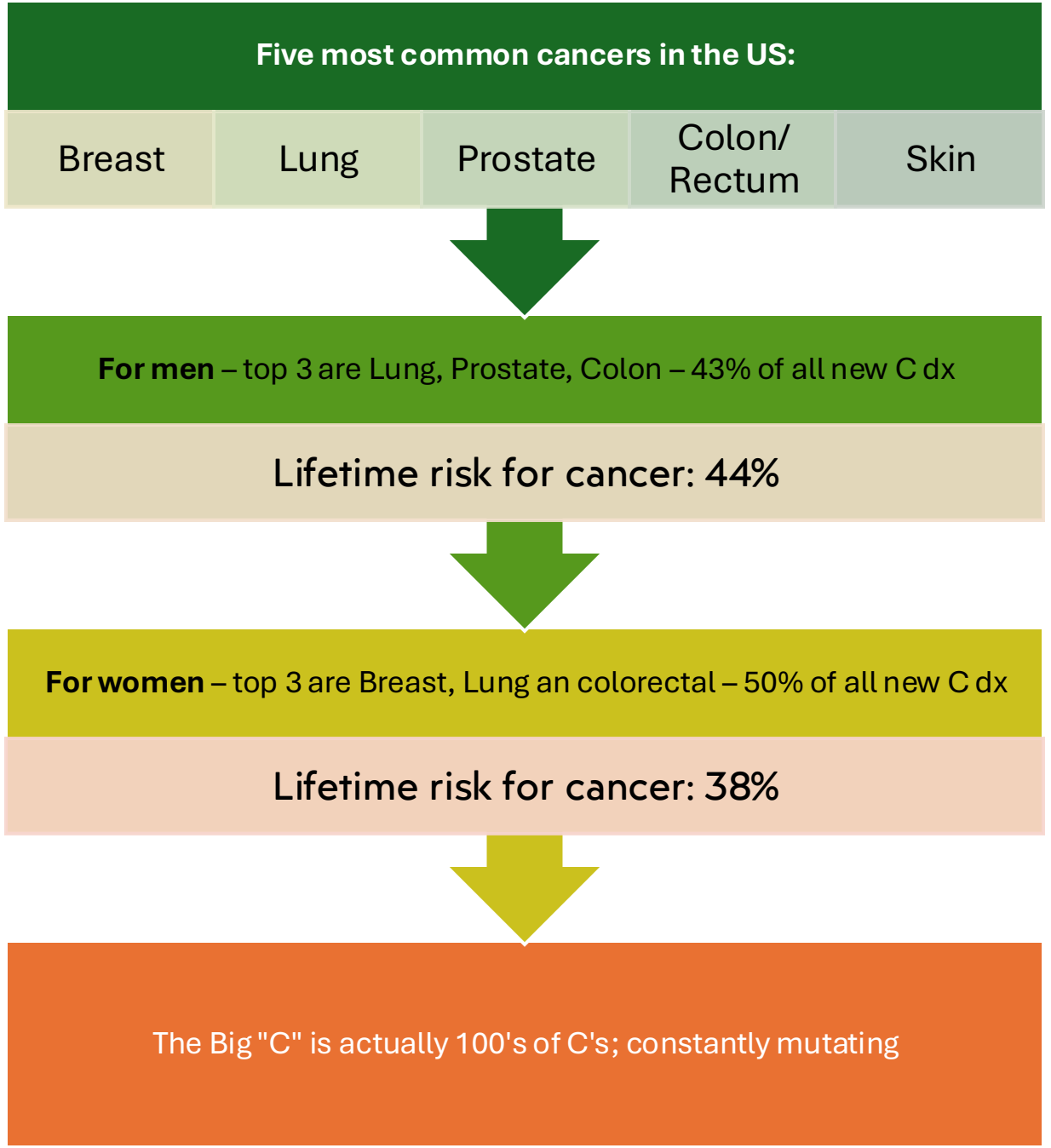
Aquatics in outpatient care – safety, supervision, individual vs. Group, liability

Aquatic research + oncology rehab research = limited, but growing

# Who are We Talking About?

- Cancer is the leading cause of death in every country globally
- Mean age of diagnosis: 66;  Average survivorship beyond 5 years:  62%
- Children (in developed countries) have higher survivorship:  80%+ beyond 5 years
- 39.5% of all women and men will be diagnosed with cancer in their lifetime
- **The numbers of new cases are growing**
- **The numbers of survivors are growing**
- By 2040, the number of new cancer diagnoses each year is expected to grow from  to 29.5 M

# Cancer Facts



# ** Learn More about the Fundamentals of Oncology Rehab!

**Cancer Diagnosis and Classification Systems : by histology, tissue, system, anatomical site, grade, stage, hormone receptor sensitivity, genomics, oncogenes, tumor biomarkers, and more**

**Primary Prevention and Risk Prediction; Correlation to Inflammation**

**Rehab Before and During Medical Treatment: Surgery, Chemotherapy, Radiation, Immunotherapy; Prehab**

**Adverse Effects of Treatment – and how Rehab can help**

**Patterns of Metastasis- bone, brain, liver, lung**

**Survivorship and surveillance; dormant and active metastasis**

**Palliative and end of life care**

**Psychosocial considerations**

**And so much more….**

# Overview of Medical Management of Cancer

35% - **Surgery** only

5% - **Radiation** only

5% - **Chemotherapy** only

60% will have surgery + chemo or radiation **combination**

- Clean margins; sentinel lymph node dissection
- **Tissue repair, reconstruction** and cosmesis

Palliative surgery – focus is on pain management, retention of function

Chemotherapy: neoadjuvant and adjuvant, **immunotherapy**

GOAL: pCR (pathological Complete Response)

# Simple Overview of Rehab Role During and Following Medical Treatment for Cancer

1. **Surgical treatment**: Breathing and post-surgical pulmonary hygiene; post-operative mobility skills; musculoskeletal re-education; edema management; wound healing; lymphedema prevention and management; pelvic floor therapy, restoration of function
2. **Chemotherapy:** Widest reach in both complexity and timing of onset of signs and symptoms. Management of chemotherapy-induced peripheral neuropathy (CIPN); balance and fall prevention; cancer-related fatigue; chemotherapy-induced cognitive impairment (CICI); combatting cardiotoxicity, weakness, inactivity
   - Cancer research breakthroughs and longitudinal studies; immunotherapy
   - Note about: Hematopoietic Stem Cell Transplant
3. **Radiation therapy:** Radiation-induced fibrosis (RIF); so important to watch 3-5 years post treatment; potential cardiac and organ scarring; contributor to many musculoskeletal disorders and lymphedema

# Post-Surgical Considerations

Sluggish and traumatized lymphatic system:  Priming the Lymphatic Pump

Loss of tissue – will it be reconstructed?  Has the anatomy changed?  Will fluid fill the space?

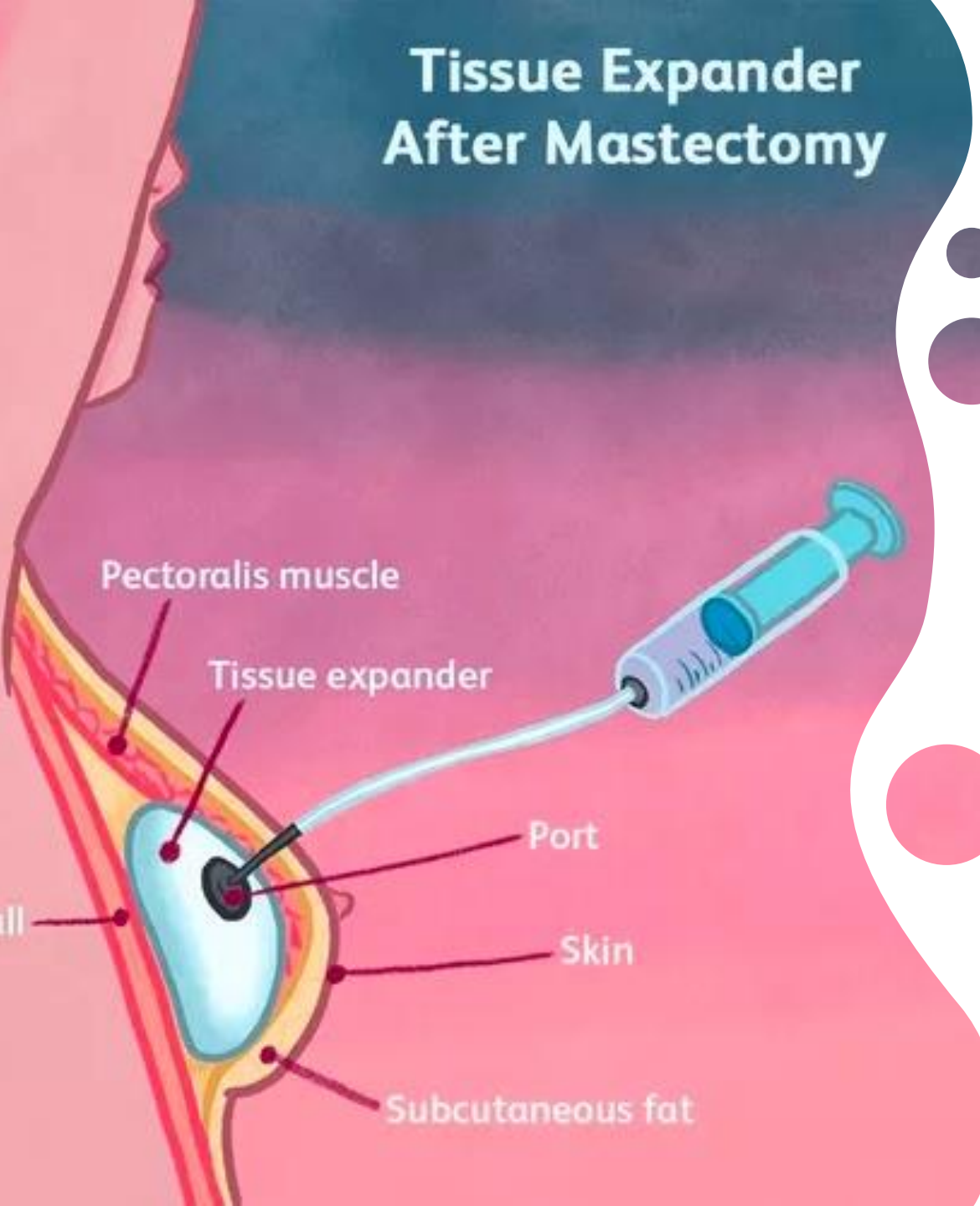
Potential weight bearing restrictions

Wound healing delay potential

Phase of Healing – anastomoses repair; early movement vs. Tissue repair

# Post-Surgical Considerations

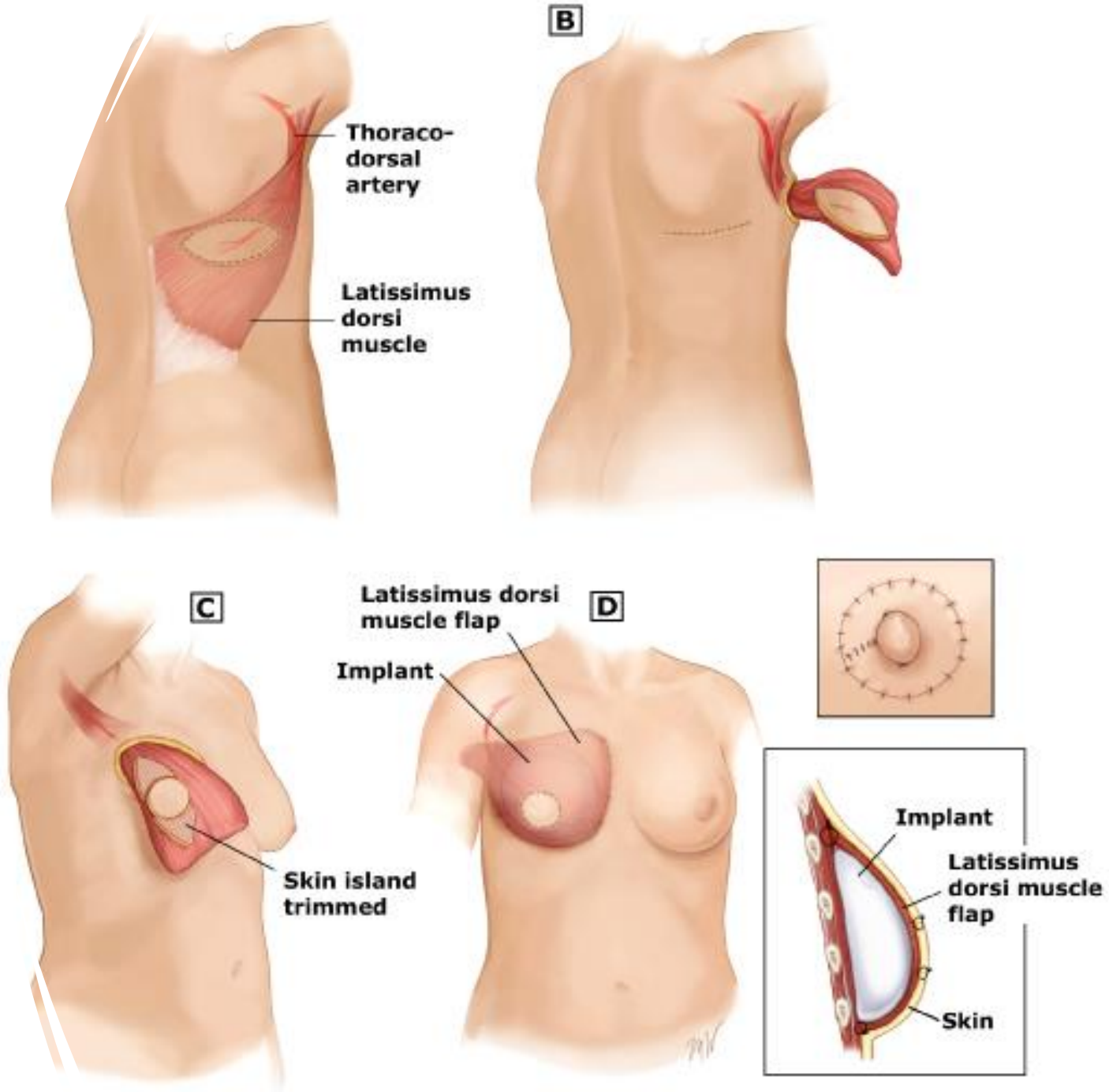
- **Seromas:** pocket of serous fluid – filling open space; more common in obese females; often take a long time to resolve – greater than 6 months; use of compression camisoles; drain with syringe
- Controversial discussion about UE mobility after surgery– stay below shoulder height or not; give lymphatics a chance to heal
- Advice to your patients about numbness: Nerve recovery – 12 to 18 months; numbness in axilla may completely go away.




# Post-Surgical Reconstruction

- Use of tissue expanders prior to implants
  - Pre-pectoral placement – over the pect major muscle; fill first with air, then saline; surrounded by self-absorbing, acellular dermal matrix
  - Submuscular placement – under the pect major;  creation of "pocket"
  - 3- 7 months; planned around radiation
- DIEP, SIEP (deep and superficial inferior epigastric perforator artery/ tissue flaps - transplant of tissue from abdomen or inner thighs to form the breast mound – no muscle involved
- Fat grafting
- TRAM  Transverse Rectus Abdominus Muscle Flap – free or pedicle style
- Post-surgical drains (JP)

# Latissimus Flap



# Other Reconstruction examples:

- **Osteosarcoma**: Rarely reconstructed for smaller bones such as fingers, toes, clavicle, forearm; but for long bones or facial/ jaw reconstruction – yes
- **Allografts:** a tissue graft from a donor of the same species as the recipient but not genetically identical
- **Autograft:** a tissue graft from the same person; non-vascularized, frozen or treated
- **Example: Rotationplasty**: for cancer around the knee; remove the proximal tibia, resect and rotate the lower leg and create a knee from ankle; add prosthesis

- ***Just like any other musculoskeletal patient, we adapt for the aquatic environment.***


- Wisanuyotin, T., Paholpak, P., Sirichativapee, W. *et al*. Risk factors and outcomes for failure of biological reconstruction after resection of primary malignant bone tumors in the extremities. *Sci Rep* **11**, 20444 (2021). https://doi.org/10.1038/s41598-021-00092-1
- Mavrogenis AF, Ruggieri P, Mercuri M, Papagelopoulos PJ. Megaprosthetic reconstruction for malignant bone tumors: complications and outcomes. J Long Term Eff Med Implants. 2008;18(3):239-51. doi: 10.1615/jlongtermeffmedimplants.v18.i3.40. PMID: 20001895.

# Chemotherapy Treatment

- ❖ Detailed approach to chemotherapy treatment is beyond the scope of our talk today.
- ❖ Subjective history is so important to understanding the whole person
- ❖ Knowing a few basics about chemotherapy regimen helps us ask the right questions and tailor our assessment accordingly.
- ❑ Chemotherapy before or after surgery?
- ❑ How long and when was last dose?
- ❑ Immediate and short-term side effects?
- ❑ Type(s) of chemotherapy?
- ❑ Ongoing maintenance or immunotherapy?

# Simple ways to group chemo adverse effects

| | | |
|---|---|---|
| "P" | Platinum based drugs | P = Peripheral Neuropathy |
| "TAX" | Taxane based drugs | Tax the PNS |
| "C" | "Cin" drugs | C is for Cardiotoxicity |
| "V" | Vinca Alkaloids | V is for the Vestibular System |
| "M" | Metabolites | M is for Mucosal linings and Mucositis |

Credit to: Julia Osborne; Physiological Oncology Rehabilitation Institute; CO

# Common Toxicities for Systemic Chemo

- Myelosuppression: anemia, thrombocytopenic (low platelet count), Neutropenia
- Cardiotoxicity: Decreased left ventricle ejection fraction; cardiomyopathy
- Peripheral Neuropathy:  Sensory first, then motor, affects Cranial Nerves, too
- GI and Gen-uro inflammation: Secondary to mucositis and skin sensitivity/ rashes
- Cancer Related Fatigue:  Both disease and treatment related
- Cognitive Impairment: cognitive fatigue; executive function impairments

Immunotherapy side effects
I = “…Itis”

- Hypophysitis
- Thyroiditis – vision, headache, confusion
- Adrenal insufficiency – hypo or hyper metabolic issues
- Enterocolitis : fatigue, low blood sugard and BP, nausea
- Dermatitis
- Pneumonitis
- Pancreatitis
- Motor and sensory neuropathies
- Arthritis

# Special note: Targeted therapy for ER+ PR+ breast cancer

**Pre-menopausal women: Tamoxifen (Novadex, Soltamox) and/ or Lupron – this will cause early-onset menopause**

- Targets estrogen receptors – ovarian produced estrogen
- Decreases risk of reoccurrence by 50% when taken for 5 years
- **Musculoskeletal concerns: loss of muscle tone, strength, tensile strength in ligaments and tendons; decreased stabilization of neck, shoulder girdle, pelvic girdle and plantar fascia, increased incidence of trigger finger and carpal tunnel syndrome**

**Post-menopausal women: Use Aromatase Inhibitors; targets the Aromatase enzyme (Arimidex, Aromasin, Femara)**

- **Same ortho concerns as above; Loss of bone density, acute tendonitis, arthralgia in vulnerable joints – small joints, weight bearing joints**

# Impact of Radiation Therapy:

# Radiation-Induced Fibrosis (RIF)

Caused by tissue exposure to radiation rays

Loss of elasticity, shortening & contracture of musculature and connective tissue

- Tendons, ligaments, fascia, skin, muscles, vessels

Decreased ROM; functional loss; pain; development of compensatory strategies

Commonly occurs 4–12 months after radiation therapy

May progress over several years; 3 – 5 year post-treatment onset is common

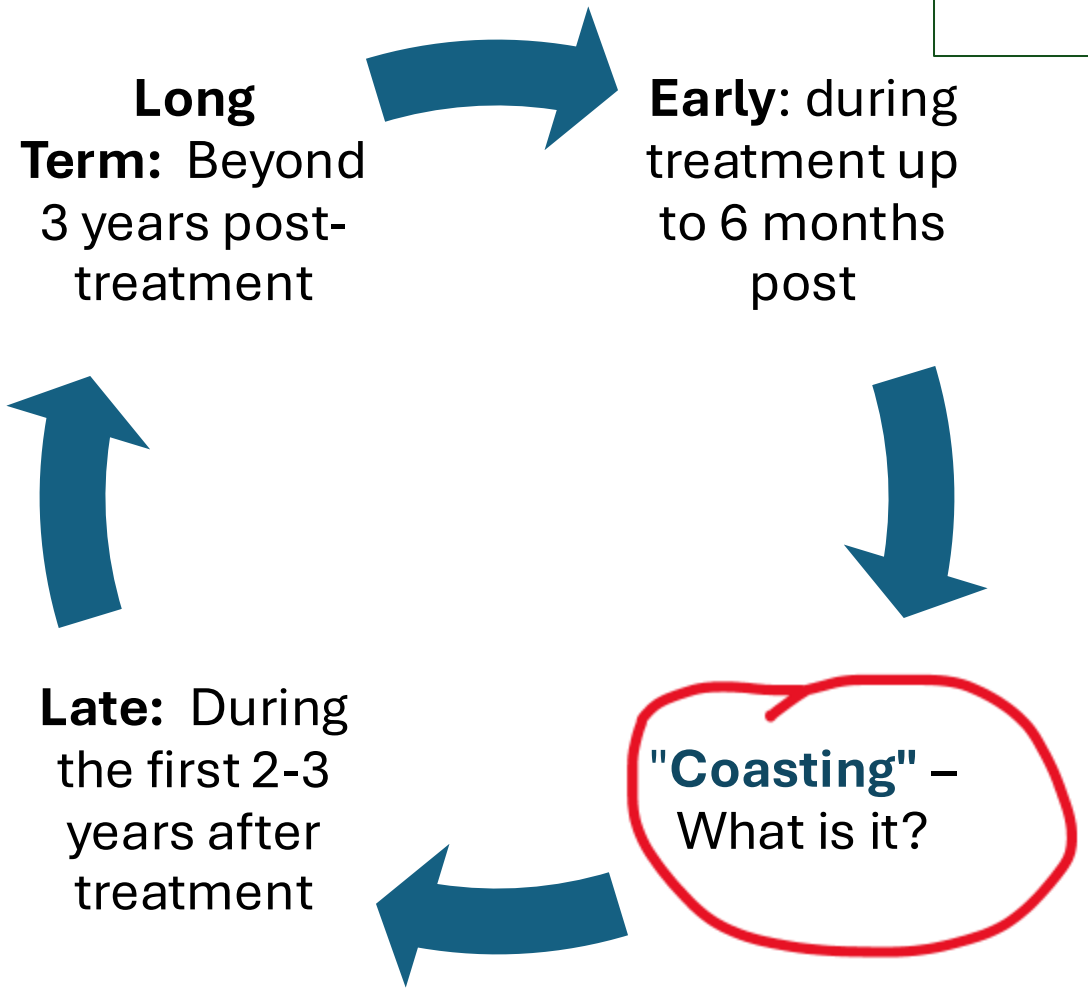
Affects almost every part of the body that is exposed to the radiation

# Overview of Primary Adverse Effects of Treatment for Cancer

- **Chemotherapy Induced Peripheral Neuropathy (CIPN)**
- **Cancer Related Fatigue (CRF)**
- **Lymphedema +/- Cording / Axillary Web Syndrome**
- **Chemotherapy Induced Cognitive Impairment (CICI)**
- **Cardiotoxicity**
- **Radiation Fibrosis**
- **Functional Impairments: Weakness, balance and falls**
- **Functional Impairment: Pelvic Floor Dysfunction**
- **Insomnia**

# Side Effects: Timing

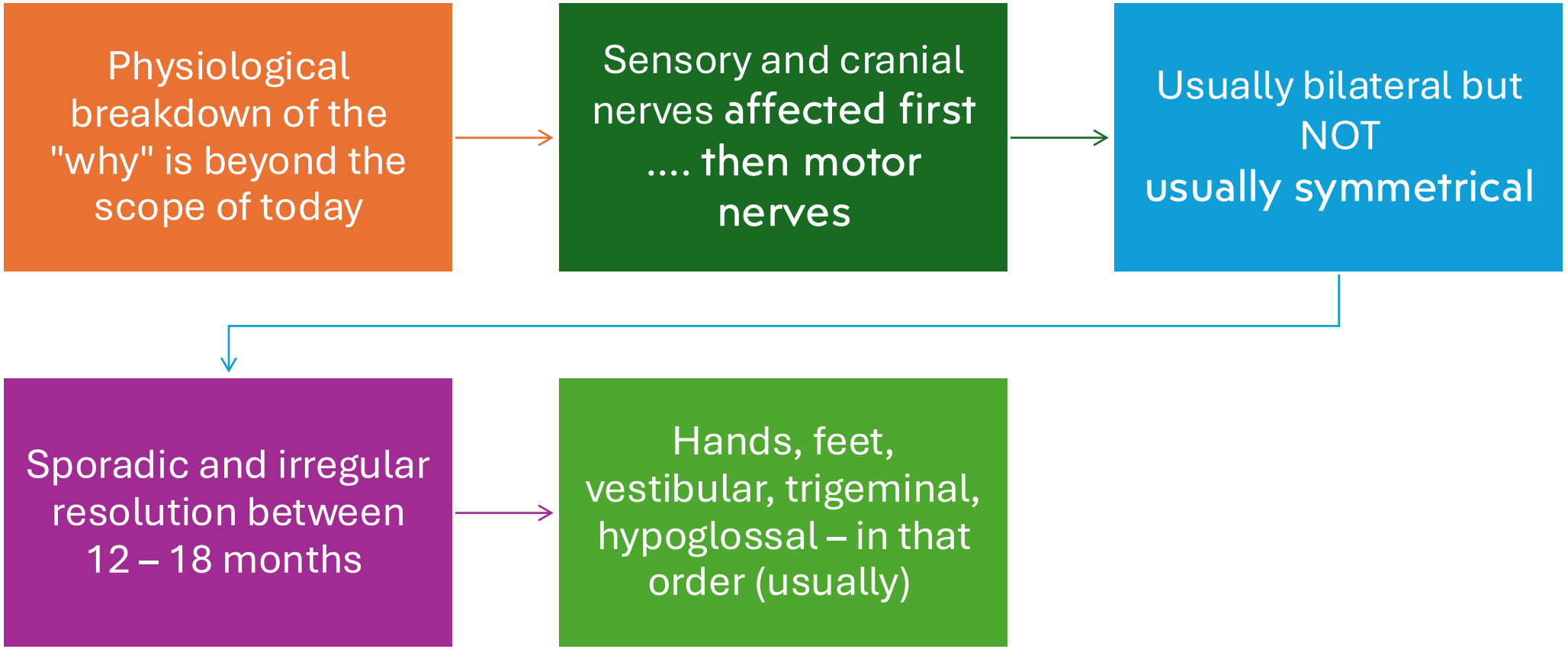
**How does the Coasting phenomenon impact physical therapy practice?**



# Oncology Rehabilitation Concepts

- **Prehab** with oncology treatment is effective and meaningful
- **Stabilization** of systems; prevention of exacerbations vs. Progression
- **Progression and restoration** of function happen; but it may be an unsteady climb
- **Optimization** of function is definitely a primary goal
- **Surveillance and monitoring** is incredibly important

# Let's start with CIPN



# CIPN

**Unilateral and assymetrical pain patterns**

**Tingling of hands & feet**

**Numbness of hands & feet**

**Pressure or heaviness**

**Assymetrical swelling or sense of "itchy-ness"**

**Remember that our Cranial Nerves are peripheral!**

**Vestibular and Balance Issues: Vestibulocochlear nerve**

**Hearing loss**

**Rectal nerve involvement: Incontinence**

**Phrenic Nerve: diaphragm and secondary respiratory musculature**

# CIPN: Assessment

https://www.youtube.com/watch?v=X3kW26L_7dA

- Use of tuning fork
- Monofilament testing
- Subjective description
- Toe Touch Assessment
- Patient Reported Outcome Measure
- FACT – GOG-NTX

# FACT/GOG-NTX (Version 4)

**Please circle or mark one number per line to indicate your response as it applies to the past 7 days.**

| | ADDITIONAL CONCERNS | Not at all | A little bit | Some-what | Quite a bit | Very much |
|---|---|---|---|---|---|---|
| NTX 1 | I have numbness or tingling in my hands | 0 | 1 | 2 | 3 | 4 |
| NTX 2 | I have numbness or tingling in my feet | 0 | 1 | 2 | 3 | 4 |
| NTX 3 | I feel discomfort in my hands | 0 | 1 | 2 | 3 | 4 |
| NTX 4 | I feel discomfort in my feet | 0 | 1 | 2 | 3 | 4 |
| NTX 5 | I have joint pain or muscle cramps | 0 | 1 | 2 | 3 | 4 |
| HI12 | I feel weak all over | 0 | 1 | 2 | 3 | 4 |
| NTX 6 | I have trouble hearing | 0 | 1 | 2 | 3 | 4 |
| NTX 7 | I get a ringing or buzzing in my ears | 0 | 1 | 2 | 3 | 4 |
| NTX 8 | I have trouble buttoning buttons | 0 | 1 | 2 | 3 | 4 |
| NTX 9 | I have trouble feeling the shape of small objects when they are in my hand | 0 | 1 | 2 | 3 | 4 |

# Treatment for CIPN

**There is limited evidence-based data available for prophylaxis and treatment of this condition.**

**Early start of functional exercises during chemotherapy is recommended. Use of Compensatory strategies**

**Certain antidepressants (amitriptyline), and anticonvulsants (gabapentin, pregabalin) may be considered.**

**Successful topical treatment of CIPN with capsaicin 179 mg patch.**

**Pelvic floor rehabilitation**

**Fall Prevention strategies**

**Oncology Academy Fact Sheet on CIPN**

Maihöfner, C., Diel, I., Tesch, H. *et al*. Chemotherapy-induced peripheral neuropathy (CIPN): current therapies and topical treatment option with high-concentration capsaicin. *Support Care Cancer* **29**, 4223–4238 (2021). https://doi.org/10.1007/s00520-021-06042-x

# Next, let's discuss CRF

**NCCN definition: a "distressing, persistent, subjective sense of physical, emotional, and/or cognitive tiredness or exhaustion related to cancer or cancer treatment that is not proportional to recent activity and interferes with usual functioning."**

**Key component: It is not relieved by rest.**

**Multifactorial etiology – we used to think it was all about anemia.**

**25% to 99% of all patients dx with & tx for cancer will experience some form of CRF.**

**30-75% report fatigue lasting months or years post-treatment.**

**Patients often under-report fatigue; relate they are “happy just to be alive.”**

**Fatigue is not just physical; emotional fatigue or "social" fatigue is real! The inability to concentrate is tied into the CICI factor of cancer treatment.**

# Assessment for CRF

| | |
|---|---|
| Patient-Reported Outcome Measures | • Piper Fatigue Scale<br>• Modified Brief Fatigue Inventory (mBFI)<br>• Functional Assessment of Chronic Illness Therapy-Fatigue Scale (FACIT – F)<br>• 10-Point Rating Scale for Fatigue |
| 2 MWT, 6 MWT | • Often unable to tolerate |
| 2 minute step test | • Great with limited space or balance issues |
| UNCCRI (Univ of Northern Colorado Cancer Research Institute) : | • 20 minutes, low level treadmill test; provides exact guidelines for peak O2 |

# FACIT Fatigue Scale (Version 4)

Below is a list of statements that other people with your illness have said are important. **Please circle or mark one number per line to indicate your response as it applies to the past 7 days.**

| | | Not at all | A little bit | Some-what | Quite a bit | Very much |
|---|---|---|---|---|---|---|
| HI7 | I feel fatigued | 0 | 1 | 2 | 3 | 4 |
| HI12 | I feel weak all over | 0 | 1 | 2 | 3 | 4 |
| An1 | I feel listless ("washed out") | 0 | 1 | 2 | 3 | 4 |
| An2 | I feel tired | 0 | 1 | 2 | 3 | 4 |
| An3 | I have trouble starting things because I am tired | 0 | 1 | 2 | 3 | 4 |
| An4 | I have trouble finishing things because I am tired | 0 | 1 | 2 | 3 | 4 |
| An5 | I have energy | 0 | 1 | 2 | 3 | 4 |
| An7 | I am able to do my usual activities | 0 | 1 | 2 | 3 | 4 |
| An8 | I need to sleep during the day | 0 | 1 | 2 | 3 | 4 |
| An12 | I am too tired to eat | 0 | 1 | 2 | 3 | 4 |
| An14 | I need help doing my usual activities | 0 | 1 | 2 | 3 | 4 |
| An15 | I am frustrated by being too tired to do the things I want to do | 0 | 1 | 2 | 3 | 4 |
| An16 | I have to limit my social activity because I am tired | 0 | 1 | 2 | 3 | 4 |

# Interventions for CRF

Address problematic systems that contribute to CRF: respiration and breathing; anxiety and fear; weakness and instability; aerobic capacity

## General Guidelines:

| | | |
|---|---|---|
| RPE: 1 – 3. during chemo and for 1 month post chemo | RPE: 3 – 6 (light to moderate) for the NEXT 3 MONTHS | RPE: 6 - 8 (moderate to vigorous). For the next 3 months (up to 7 month post treatment point) |

# Lymphedema

Oncology- related lymphedema is classified as "Secondary Lymphedema."

Accumulation of protein-filled fluid that gravitates to the interstitial space and exceeds the transport capacity of the lymphatic system – because of obstruction or injury to the lymphatic system

1 in 5 patients with breast cancer will develop lymphedema

Risk for lymphedema is for life, but 89% of those diagnosed experienced onset within 2-3 **years**; post treatment.

90% of persons with head and neck cancer will develop lymphedema within 18 months post treatment

37% of people following treatment for gynecological cancer will experience lymphedema within 12 months.

Oncology Rehabilitation: A Comprehensive Guidebook for Clinicians; Elsevier; 2022; Doherty; Wilson; Boright; ISBN: 978-0-323-81087-6

# Quick Review of Stages of Lymphedema

| Stage 0 | Stage 1 | Stage 2 | Stage 3 |
| --- | --- | --- | --- |
| Sub-clinical; Reversible; lymph fluid and inflammation is in interstitum | Sub-clinical; Reversible; less than 5% volume increase or less than 2% circumferential increase; Lymphedema responds to positional change and elevation | Clinical; management plan should exist for life; secondary skin changes begin to appear – fibrosis; greater than 10% volume increase; greater than 2 cm circumferential increase | Clinical; management for life; Lymphedema plus secondary skin disease; has progressed to solid phase |

Credits: Oncology Rehabilitation; 2022; Chapter 9; Lymphedema; J. Osborne

# Risk for Lymphedema

Sentinel lymph node dissection vs. Axillary node dissection

Extent of surgical resection; scar tissue

Number of surgical procedures

Infections;  fluid issues – presence of seroma

Regional and/ or targeted radiation

BMI over 30

Chemotherapy:  Use of taxanes

Immunotherapy:  side effect of joint pain; arthritis; limiting ROM and mobility

# Assessment

- Bioimpedence Testing
- Volumetric readings
- Tape measure

# Lymphedema Interventions

| | |
|---|---|
| Teaching: | Patient Education on Lymphatic load management |
| | Skin Care |
| Early Surgical Interventions | Lymph Node Transplant |
| | Lympho-Venous Anastomosis |
| Complete Decongestive Therapy | MLD, education, compression |
| | exercise, skin care |
| Manual Lymph Drainage: | **Musculoskeletal** pumping, tissue bending |
| | **Lymphatic** strokes and sequences – mobilizing fluid |
| Connection to certified therapists | Build a network for referrals |
| Maintenance compression garments; **pneumatic** pumps | ** Aquatic interventions show greater compliance |

# Axillary Web Syndrome

- Commonly called "cording"
- More common in thinner, lower BMI patie
- Manual Techniques work beautifully in the water

# Cardiotoxicity

**Primary impact of chemotherapy (doxyrubicin is a primary culprit) . Radiation can be a contributor as well.**

**Increased** production of nitric oxide, inhibition of reactive oxygen pathways; apoptosis of cardiomyocytes; increased cardiac workload and endothelial dysfunction ---- all contribute to decreased EF and CHR

Left ventricular ejection fraction rate (LVEF) - becomes less than 50%

**Concerns surround potential for congestive heart failure or myocardial infarction**

Prophyllatic, baseline echocardiograms more routinely ordered prior to treatment

**Significant population of adults who received treatment as a child – with undetected issues – that could benefit from intervention**

# More on Cardiotoxicity

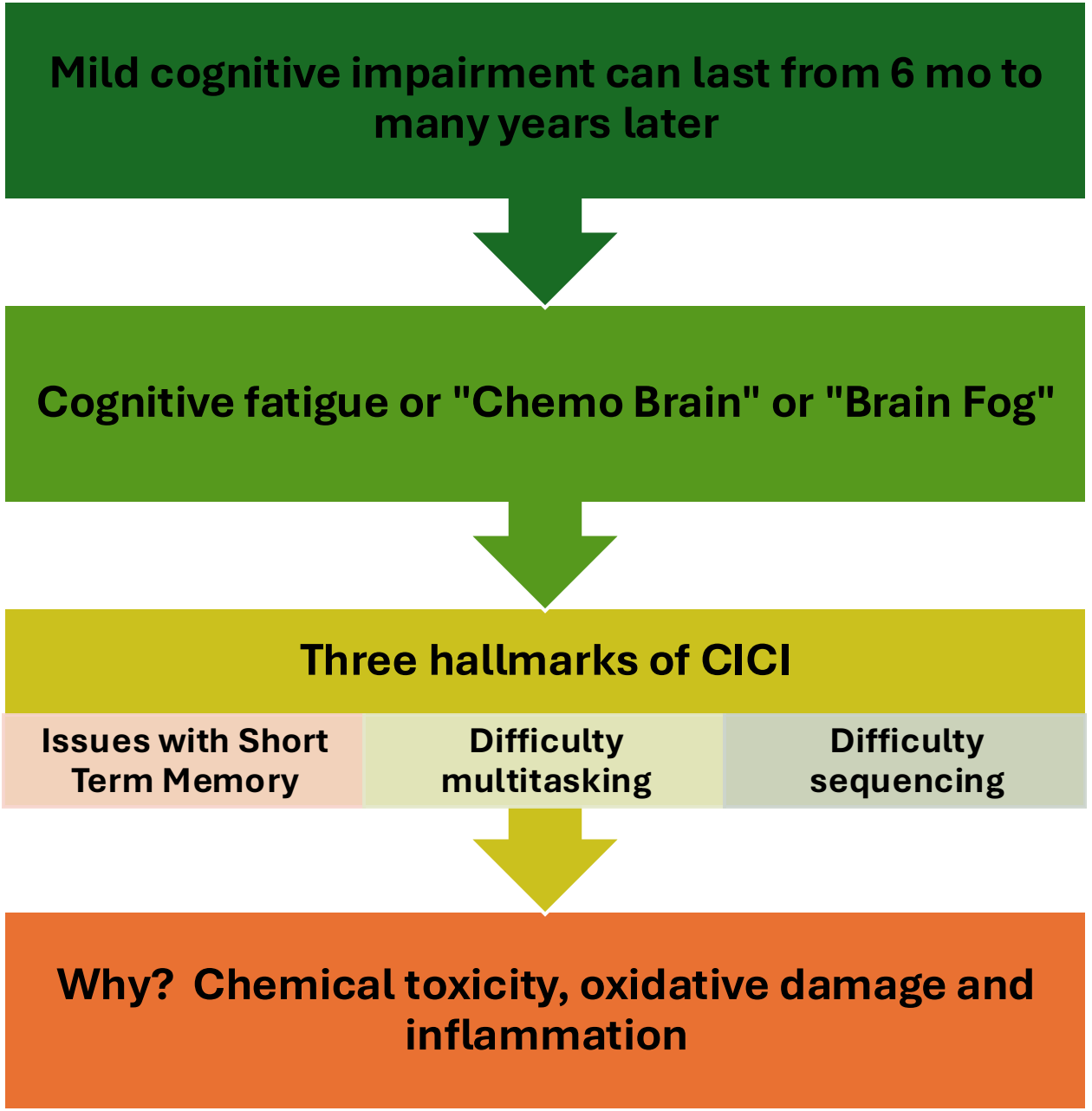
Cancer treatment–related cardiotoxicity is the **third leading cause** of treatment-associated death in survivors of pediatric & adolescent cancers.

Incidence of treatment-induced heart damage in pediatric survivors of cancer increases over time, even after 30 years post-therapy.

In adult patients, cardiotoxicity is agent-dependent, & incidence can be as high as 50%, depending on the type of cardiac condition.

Shelvurne et al.J Natl Cancer Inst. 2014 Sep 10;106(9)

# CICI


Mild cognitive impairment can last from 6 mo to many years later
Cognitive fatigue or "Chemo Brain" or "Brain Fog"
Three hallmarks of CICI
Issues with Short Term Memory
Difficulty multitasking
Difficulty sequencing
Why? Chemical toxicity, oxidative damage and inflammation

# Assessment and Treatment of CICI

MoCA

Trailmaking Test

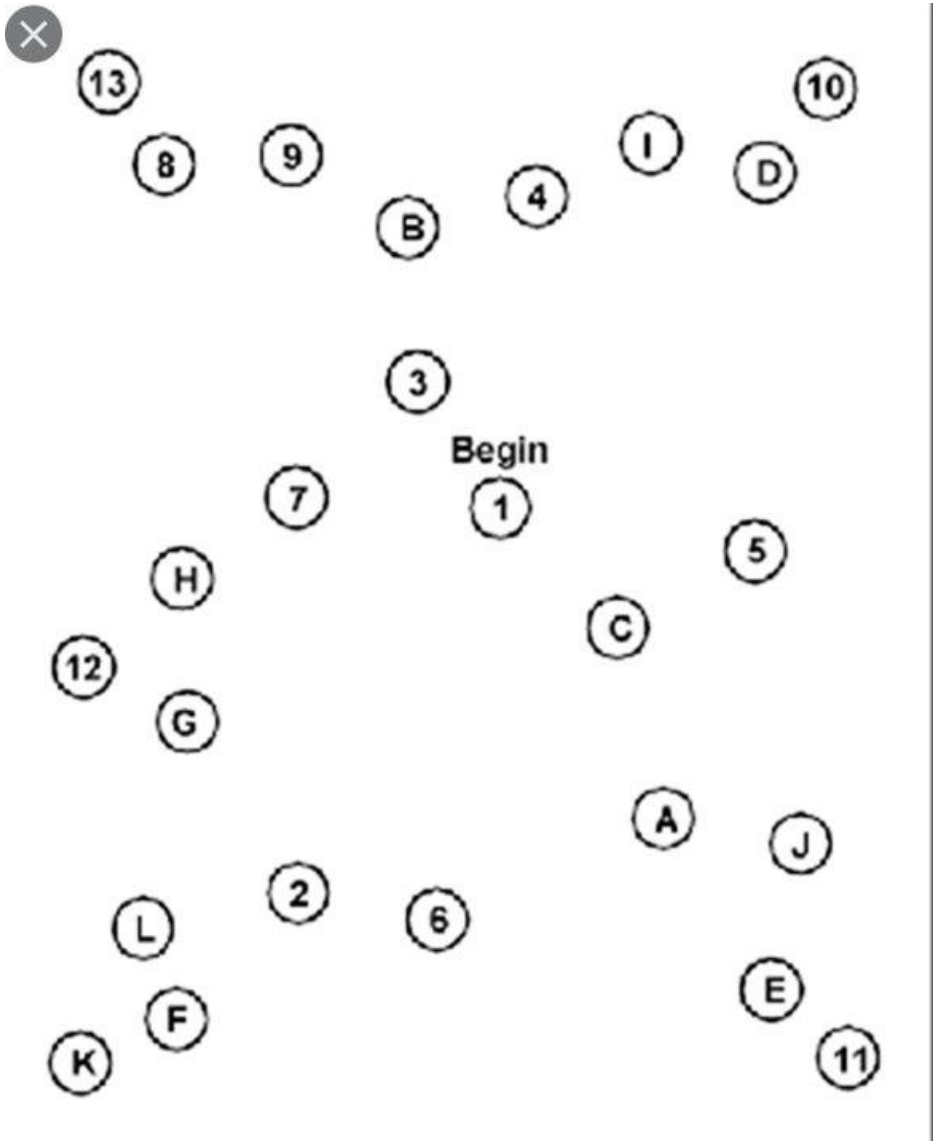
Clock Drawing Test

FACT-COG. ( all FACT assessment tools are available at FACT.org.).

"FACT " prefix = Functional Assessment of Cancer Therapy

No Gold Standard for assessment or treatment

# Example of Trailmaking Test



# Radiation Induced Fibrosis: What does it look like?

- Skin thickening - "induration"
- Muscle shortening
- Atrophy
- Limited joint mobility
- Nerve damage & pain
- Lymphedema
- Mucosal fibrosis
- Ulcerations and skin breakdown
- **WHAT YOU DON'T SEE**
- **Timing: Late Onset**

# Assessment and Treatment of RIF/ RFS

- Manual assessment tool:  MAP-BC
- Clock assessment of tissue extensibility (Superficial and deep) around drain sites; incisions and anywhere that radiation penetrated, including tissues on the other side of the body
- Manual techniques by therapist:  Myofascial Release; positional releases
- Surgical:  autologous fat grafting
- Surgical/ Injections:  Cell-assisted lipotransfer (CAL) with deferoxamine (DFO) injection first to make the environment friendly – improved vascularization, enhanced wound healing

# Functional Impairment: Pelvic Floor Dysfunction

Combination of impact from chemotherapy, radiation, immunotherapy and impact on endocrine system

Muscle/ligament weakness/damage affecting function of the lower genitourinary systems

Continence issues of the bladder & bowel

Affects both males and females

Quality of Life issues:  isolation, sexuality

# Phase of Healing after Tissue Trauma

Considerations with Care Planning;  Tissue Healing

0 – 14/21 days  Inflammation

14+ - 30/45  Proliferation

Beyond 45 days  Maturation

Plenty of overlap in stages of healing with tissue types

# 5 Reasons Why Aquatic Therapy Makes Sense

# 1. Use of Hydrostatic Pressure Properties

Stimulation of lymphatic system

Use of myofascial release; diaphragm release; abdominal node sequence; short and long neck sequence; priming the pump

Compression during movement

Excellent medium for self – manual lymph drainage

Sensory and vestibular feedback during static and dynamic balance activities

Great for the stabilization of lymphatic system

Compliance is a positive outcome of aquatic therapy with lymphedema

Energy expenditure is less; able to tolerate more and obtain a training level

# 2. Balance and Core Strength Development:  drag, surface tension, buoyancy

Safe and effective setting for balance progression

Potential opportunity to enhance musculoskeletal coordination and re-education:  able to tolerate higher number of reps for motor learning

Activation of pelvic stabilizers and multifidi with minimum energy output

# 3. Effective for Cardiopulmonary Progression

Less impact on joints during efforts to increase C-P training intensity

Muscular strength and endurance doesn't limit the ability to attain necessary RPE's

Peripheral vascular tree – Vasodilation is positive **result**

Use of RPE guidance in various post-treatment phases of recovery

Focus on STABILIZATION and OPTIMIZATION of function

# 4. Psychosocial Factors

Body Image; sensation of "light" and freedom of movement

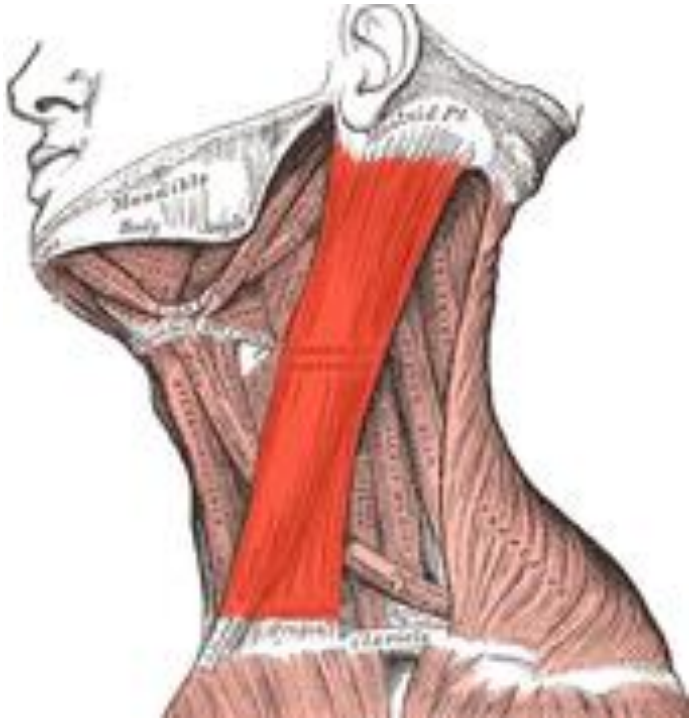
Sense of control

Excellent, long term carry-over activity – it's a long journey

Individual sessions and group activities can be transformational and supportive

# 5. Perfect Therapeutic Exercise and Manual Therapy Medium

- Efficient methods of changing intensity of exercise without changes to equipment – using speed, lever arm length, and surface area changes
- Can incorporate balance and cognitive activities easily and safely
- Able to provide effective stretching and manual techniques with tissue warming and suppression of resting tone



# Cervical Muscle Issues

- Breast cancer survivors exhibit great activation of sternocleidomastoid muscles and upper trap muscles during upper extremity activities
- Need to be "down trained" and lengthened
- May contribute to neck and shoulder dysfunction down the road if unchecked

- Galiano-Castillo et al, **Altered Pattern of Cervical Muscle Activation During Performance of a Functional Upper Limb Task in Breast Cancer Survivors,** AJPMR, Vol. 90.no.5, May 2011., pg 350-355.

# What Evidence Supports Oncology Rehab in the Aquatic Setting

- Fatigue
- QOL
- Lymphedema
- Pain
- Quality of Sleep

# Aquatic Evidence:  Cancer Related Fatigue

- Breast Cancer cohort:  Meta-analysis; Analysis of fatigue, waist circumference and QOL.
- Fatigue and QOL improved significantly, no impact on waist circumference
- During aquatic exercising, oxygen consumption is 3 times greater at a given speed in water than on land, thus a training effect may be achieved at a significantly slower speed than on land.
- 60- minute aquatic exercise sessions; 3 x week; 8 weeks; deep water, aerobic focus


- Wang J, Chen X, Wang L, Zhang C, Ma J, Zhao Q. Does aquatic physical therapy affect the rehabilitation of breast cancer in women? A systematic review and meta-analysis of randomized controlled trials. PLoS One. 2022 Aug 3;17(8):e0272337. doi: 10.1371/journal.pone.0272337. PMID: 35921372; PMCID: PMC9348687.
- Cantarero-Villanueva I, Fernández-Lao C, Cuesta-Vargas AI, Del Moral-Avila R, Fernández-de-Las-Peñas C, Arroyo-Morales M. The effectiveness of a deep water aquatic exercise program in cancer-related fatigue in breast cancer survivors: a randomized controlled trial. Arch Phys Med Rehabil. 2013 Feb;94(2):221-30. doi: 10.1016/j.apmr.2012.09.008. Epub 2012 Sep 24. PMID: 23017985.
- Becker BE. Aquatic therapy: scientific foundations and clinical rehabilitation applications. PM R. 2009;1(9):859–72. doi: 10.1016/j.pmrj.2009.05.017
- Puetz TW, Herring MP. Differential effects of exercise on cancer-related fatigue during and following treatment: a meta-analysis. Am J Prev Med. 2012;43(2):e1–24. doi: 10.1016/j.amepre.2012.04.027

# Aquatic Therapy and Lymphedema

- Study on patients with breast cancer – specific protocol desribed – only treated in the aquatic environment. 14 months – no recurrence and limb volume reduced significantly.


- Tidhar, D., Katz-Leurer, M. Aqua lymphatic therapy in women who suffer from breast cancer treatment-related lymphedema: a randomized controlled study. *Support Care Cancer* **18**, 383–392 (2010). https://doi.org/10.1007/s00520-009-0669-4
- Tidhar, Dorit BPT1; Shimony, Avi MD2; Drouin, Jacqueline PT, PhD3. Aqua Lymphatic Therapy for Postsurgical Breast Cancer Lymphedema. Rehabilitation Oncology 22(3):p 6-14,


- Aquatic lymphedema therapy was found to be a safe treatment method, with high adherence, in treating women who suffer from mild to moderate lymphedema. A significant immediate and insignificant long-term effect on limb volume was noted.


- Letellier ME, Towers A, Shimony A, Tidhar D. Breast cancer-related lymphedema: a randomized controlled pilot and feasibility study. Am J Phys Med Rehabil. 2014;93(9):751–9. doi: 10.1097/PHM.0000000000000089 .


- Treatment was effective; not superior to land-based outcomes. Should be patient preference


- Wai Yeung and Adam I Semciw.Aquatic Therapy for People with Lymphedema: A Systematic Review and Meta-analysis.Lymphatic Research and Biology.Feb 2018.9-19.http://doi.org/10.1089/lrb.2016.0056

# Aquatic Therapy and Pain

**Study supports aquatic therapy as an effective treatment for pain related to immunotherapy-induced joint arthralgia**

Cantarero-Villanueva I, Fernández-Lao C, Caro-Morán E, et al. Aquatic exercise in a chest-high pool for hormone therapy-induced arthralgia in breast cancer survivors: a pragmatic controlled trial. Clinical Rehabilitation. 2013;27(2):123-132. doi:10.1177/0269215512448256

**High-quality evidence supported the use of aquatic therapy for reducing CRF, and acceptable quality evidence supported the use of aquatic therapy for reducing pain. Adverse responses to aquatic therapy were minor symptoms that resolved within days and had no effect on attrition.**

Barbagelata, Karsten DPT1; Eadi, Jacqueline DPT1; McNamara, Marissa DPT1; Sayles, Melissa DPT1; Smith, James M. DPT1,2. Aquatic Therapy Reduces Pain and Fatigue in Breast Cancer Survivors: A Systematic Review. Rehabilitation Oncology 39(3):p E35-E41, July 2021. | DOI: 10.1097/01.REO.0000000000000247

# Aquatic Therapy and Pediatric Oncology

- **The Aqua-PLYO exercises. ( specific protocol defined in article) can effectively improve bone health, increase functional capacity, and promote a better quality of life in long-term survivors of childhood ALL.**

- Elnaggar R, Mohamed R. Aqua-Plyometric Exercises: Potential Implications for Bone Mineral Density, Functional Capacity, and Quality of Life in Survivors of Childhood Acute Lymphoblastic Leukemia, 2021. Seminars in Oncology Nursing, 37(6); ISSN 0749-2081, https://doi.org/10.1016/j.soncn.2021.151225.

- **Family Oriented Rehabilitation (FOR) study for 4- week aquatic programming – met the goals of stabilizing the family unit and improving QOL; recommended long term**

- Krauth K, A: Family-Oriented Rehabilitation (FOR) and Rehabilitation of Adolescents and Young Adults (AYA) in Pediatric Oncology. Oncol Res Treat 2017;40:752-758. doi: 10.1159/000484609

# Aquatic Therapy and Sleep

- **No specific studies could be identified that were specific to oncology patients and sleep using aquatic interventions.**
- Sleep disturbance is one of the most frequent patient complaints and concerns throughout the cancer treatment period.
- Six weeks of moderate-intensity aquatic exercise may improve sleep efficiency and reduce pain for persons suffering chronic MSK pain.


- So BCL, Kwok SC, Lee PH. Effect of Aquatic Exercise on Sleep Efficiency of Adults With Chronic Musculoskeletal Pain. J Phys Act Health. 2021 Jun 30;18(9):1037-1045. doi: 10.1123/jpah.2020-0476. PMID: 34193628.


- Pediatric:  Statistically significant difference existed for sleep latency ($p < .001$) and sleep duration ($p < .001$). These results suggest that participation in aquatic exercise may improve the sleep habits of children with ASD.


- Oriel, K. N., Kanupka, J. W., DeLong, K. S., & Noel, K. (2016). The Impact of Aquatic Exercise on Sleep Behaviors in Children With Autism Spectrum Disorder: A Pilot Study. Focus on Autism and Other Developmental Disabilities, 31(4), 254–261. https://doi.org/10.1177/1088357614559212

# Other Scientific Support

- **Aquatic Therapy is an effective, safe mode of exercise in post-laryngectomy patients**

- Buntzel J; Buntzel H, Mucke R, Besser A, Micke O. Sport in the Rehabilitation of Patients After Total Laryngectomy. Anticancer Research Jun 2016, 36 (6) 3191-3194

- **Aquatic Lymphedema Treatment – focused on the LE.** The study was completed with 30 ALT and 27 control group participants. Foot volume was assessed by a water displacement device, limb volume by circumference measurements, functional capacity by a 6-minute walk test, quality of life by Short Form-36, and social appearance by Social Appearance Anxiety Scale and hopeless by Beck Hopeless Scale.
- The ALT and the control group had group sessions twice in a week for 6 weeks directed by a physiotherapist.The mean age of ALT patients was 44.50 ± 13.69 years, whereas that of the control patients was 47.66 ± 16.82 years. **After the intervention, both groups' measurement of edema, functional level, quality of life, as well as social and future concerns improved significantly but this improvement was higher in the ALT group** ($p < 0.05$, $p \leq 0.001$).

- Gulbin Ergin, Didem Karadibak, Hulya Ozlem Sener, and Baris Gurpinar.Effects of Aqua-Lymphatic Therapy on Lower Extremity Lymphedema: A Randomized Controlled Study.Lymphatic Research and Biology.Sep 2017.284-291.http://doi.org/10.1089/lrb.2017.0017

# Let's Talk about Safety: for your practice

- Comprehensive list of red, yellow, green "light" resources for critical decision making in Aquatic Therapy is available through Aquatic Academy
- Component of the Certificate in Aquatic Therapy Competence program

# Primary Considerations: Skin

Radiation oncologists recommend 4 weeks post final radiation visit; asymptomatic skin

**Chemotherapy and radiation can cause skin sensitivity that reacts to chemicals such as chlorine**.

Some physicians will request no aquatic therapy for severely immunosuppressed patients because bacteria and other microorganisms thrive in warm water

Wounds – use same precautions; some therapists cover all healed incisions to lower risk

Port Site – Cover with occlusive dressing

# Aquatics and Immunosuppression

| Risk of Infection based on Absolute Neutrophil Count (ANC) | |
|---|---|
| ANC > 1500 | No increased risk of infection |
| ANC 1000-1500 | Slight increased risk of infection |
| ANC 500-1000 | Moderate increased risk of infection |
| ANC 100-50 | High risk of infection |
| ANC less than 100 | Extremely high risk of infection |

http://chemocare.com/chemotherapy/side-effects/infection.aspx#.VTfOnE10yUk

# Aquatics and Myelosuppression

- What do we see with anemia, thrombocytopenia and neutropenia?
- Fatigue
- SOB
- Increased HR and RR
- Easy Bleeding; Nose and gum bleeds
- Fever or Chills
- Rash

# Aquatics and CIPN

1. Recommend pool shoes to avoid an undetected injury to skin
2. Patient education:  Fall Risk
3. Share high risk areas of locker room and pool setting
4. Mark all changes in flooring levels very clearly

# Aquatics and Cardiotoxicity

- If Ejection Fraction is determined, use the same guidelines when making the decision to pool or not to pool
- Monitor patient with pulse oximetry – every time
- Constantly reinforce use of Perceived Exertion
- HR's are higher in patients actively in cancer treatment.

# Post-Op Heart Rate Guidance

- For the first 6 weeks, keep heart rate at 100 or below.
- Allows for anastomosis to repair with less stress on endothelium

# Cardiopulmonary Considerations

With immersion above diaphragm or at xiphoid process level, the central venous **pressure** into the right atrium increases by 15-20 mmHg. Stroke Volume increases by 35-45%.

Japanese investigators studied patients with severe congestive heart failure (mean ejection fractions 25 ± 9%). They reasoned that because exposure to a warm environment causes peripheral vasodilatation, a reduction in vascular resistance and cardiac after load might be therapeutic.

During a series of studies, these researchers found that during a single 10-min immersion in a hot water bath (41°C), both pulmonary wedge pressure and right atrial pressure dropped by 25%, whereas cardiac output and stroke volume both increased.

In a subsequent study of patients using warm water immersion 1-2 times per day, 5 days per week for 4 weeks, they found improvement in ejection fractions of nearly 30% accompanied by reduction in left ventricular end-diastolic dimension, along with subjective improvement in quality of life, sleep quality, and general **well-being**.

**Meyer** K. Left ventricular dysfunction and chronic heart failure: should aqua therapy and swimming be allowed? Br J Sports Med. 2006 Oct;40(10):817-8. doi: 10.1136/bjsm.2006.029165. Epub 2006 Sep 21. PMID: 16990443; PMCID: PMC2465076.

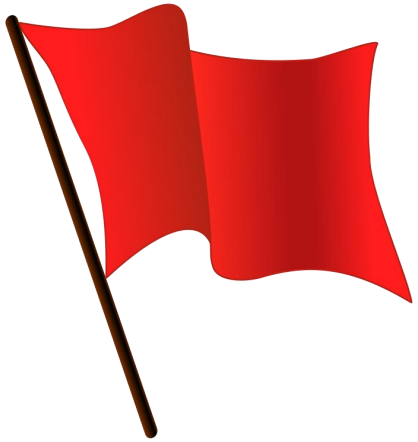
Cider A, Sunnerhage KS, Schaufelberger M, Anderson B. Cardiorespiratory effects of warm water immersion in elderly patients with chronic heart failure. Clin Physiol Funct Imaging 2005;25:313-317.

# What about Aerobic Conditioning?

- Always include this in treatment – Consider early on in two parts:
  - Warm up – 5 minutes
  - Following myofascial release
- Resting normal heart rate may be running around 100 during treatment or early post Rx
- With cardiotoxicity, heart struggles with cooldown; may plateau at 130
- Be thinking about calories here too – with huge weight loss or cachexic patients

# Oncological Rehab: Red and Yellow Flags

- **Complex patients require in-depth, team decisions.**
- YELLOW FLAGS: Use caution
- **White Blood Count:** Less than 1.5 109/L (mild) - to less than .5 109/L (severe)
- Discuss with physician or nurse navigator
- **Platelets:** Less than 150,000 cell/ uL = thrombocytopenia
- Aquatic therapy is safe as low as 30,000 cell/uL. Monitor for fall risk and injury prevention
- **Hemoglobin:** Less than 8 g/dL (severe anemia)
- May need transfusion; Reminder: normal for males (14-17.4 g/dL); females: 12-16 g/ dL



Most common from mets from prostate, lung, and breast cancer

Affect 5 – 10% of all patients with cancer

# Oncological Emergencies: Red Flags

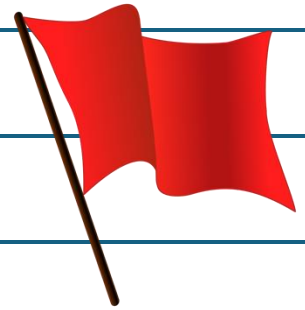
- **Structural: Spinal Cord Compression:**
- Pain is the most frequent presenting symptom- usually a solid 8 wks before diagnosed; localized back pain; usually in thoracic area (70%) from breast and lung; 20% from lumbar with GU types of cancers
- Escalates in supine; at night; with cough or sneeze
- Evaluate for muscle weakness and sensory changes

# Onc Emergencies: Malignant Pericardial Effusion

| |
|---|
| Quite rare as primary tumor source; more likely from **metastisis** secondary tumor **and radiation** |
| Results in cardiac tamponade and reduced cardiac output |
| Dyspnea, engorged neck veins; congested cough, fatigue |
| Drop in systolic blood pressure of more than 10 mm Hg during **inspiration- pulsus paradoxus** |
| Hypotensive; tachycardic |
| Watch for cognitive changes; confusion; high risk for seizures |

# Onc Emergencies:  Superior Vena Cava Syndrome

| |
|---|
| Slow and progressive onset; **60% of cases are caused by thoracic malignancies – lung, breast, prostate** |
| Swelling in upper thorax, face, **periorbital area**, neck; jugular vein distention |
| Worse in the morning; improves throughout the day |
| Dry cough; dyspnea |
| Hypotensive, cyanotic |
| Avoid valsalva maneuver |
| Central nervous sytem symptoms: confusion, headache, vision changes |
| **Treated with chemo and targeted radiation or stent to relieve compression** |



# Onc Emergencies:  Tumor Lysis Syndrome

- Typical onset is during acute 6 to 72 hours post chemotherapy delivery
- Symptoms:  nausea/ vomiting; weakness; fatigue; lethargy; arthralgia
- Be aware and alert for sudden changes such as dramatic dip in strength; muscle cramping; CNS changes; irregular heart rhythms

# Oncologic Emergencies: Neutropenic Fever

- **101 degree fever in combination with a low ANC (Absolute Neutrophil Count)**
- Classic signs of infection are usually missing

# Also watch for SIGNS OF DVT

Swelling, redness and extreme tenderness in extremity - (UE's too!)

Pulmonary emboli – dyspnea, tachycardia, crackles, hemoptysis, chest pain, tachypnea

Request imaging with doppler; immediate assessment – to the ER

Homan's sign is really not specific or sensitive enough for reliability

# "Black" Flags: Along a Very Long Journey

- Barriers to always remember
- **Financial considerations**
- Frequency of visits
- Individual vs. Group
- Sustainable access to lifelong exercise

# Article Review #1: Effect of Aqua Therapy Exercises on Postmastectomy Lymphedema: A Prospective Randomized Controlled Trial

**Khadra Mohamed Ali, PhD, Eid Rizk El Gammal, PhD, Hadaya Mosaad Eladl, PhD**

- **Department of Physical Therapy for Surgery, Faculty of Physical Therapy, Cairo University, Giza; 2Department of Oncosurgery, Faculty of Medicine, Al-Azhar University, Cairo, Egypt**

- Comparison of land-based protocol of MLD vs. aquatic exercise – both 3 x week for 8 weeks.
- 50 subjects
- Statistically better results in Visual Analog Scale (pain), QOL, Shoulder flexion and abduction range of motion and limb volume
- **"Conclusion:** Adding aqua therapy resistance exercise to routine physical therapy might be more effective in decreasing the limb volume and pain intensity and improving ROM of the shoulder in postmastectomy lymphedema."

# Aquatic Activity Considerations with Patients Recovering from Breast Cancer

**Circulation**: So important with peripheral neuropathy; lymphatic load management

Tissue tension – start the remodeling forces within ranges

Activate inhibited muscle groups

- **Shoulder stabilization – start from** posterior trunk, abdomen; obliques; deep cervical flexors

Posture reinforcement

**Assisted stretching** (not just PROM) ; downtrain SCM; trunk rotation

Sub-maximal isometrics:  motor control, circulation; muscle recruitment

UE Neural **gliding**

Lymphatic mobilization – consider everyone as grade 0  if you don't see anything

# Article Review #2: Effects of aquatic exercise program versus on-land exercise program on cancer-related fatigue, neuropathy, activity and participation, quality of life, and return to work for cancer patients: study protocol for a randomized controlled trial

- **Michal Nissim, Yakir Rottenberg, Naama Karniel and Navah Z. Ratzon**
- 150 cancer patients aged 18–65 years with stage III colon cancer or breast cancer patients with lymph node involvement.
- Comparison of aquatic protocol, land-based protocol and no exercise control group – 3, 12 and 24 months post-treatment
- Aquatic Protocol focused on use of Ai Chi, 2 x week x 8 weeks ( same for land program)
- "The potential benefits include an earlier return to work for patients, reducing their need for social and economic support. The study's implications on socio-economic policies are noteworthy, as a successful intervention could offer a cost-effective and non-invasive solution, improving patients' quality of life and increasing their participation in daily activities. This, in turn, could lead to a faster return to work, contributing to both personal well-being and broader societal interests by reducing reliance on social services. "

# Key Takeaways

The oncology population may just be the **most underserved population** across the lifespan in the US  who could benefit from physical therapy.

Armed with the knowledge of aquatic physics and oncological rehab principles, **aquatic therapy for this population is safe, efficient, and effective**, with the potential for improved patient compliance and lifelong survivor strategies.

Opportunities to treat **multiple adverse effects –** balance impairments from CIPN, strength deficits, fatigue, lymphedema – as well as psychosocial considerations may be optimized in an individual and group aquatic setting.

We need much **more research in this combined area of practice interest – aquatic therapy and oncology rehab.**

# Implications to Future Practice

Early exposure to the oncology specialty area – entry level education

Grow and expand modular, self-paced education options for PT's and PTA's education about aquatics and oncology care

Seek, support and partner with community-based programs and support groups related to cancer. Be a part of the survivorship and surveillance teams.

Develop both direct access and referral-based business promotion tools to increase awareness and reach the underserved

Keep the conversation going.  Post info about prevention and screening to match oncology awareness month

Consider establishing a state-wide SIG.  Tool Kit for doing this is on the Oncology Academy SIG site.

# We Don't Know What We Don't Try

- **Do you need more of that feeling of really making a difference?**

- **Oncology + Aquatics = BFF's**
- **Bucket Filler Forever**

hjldeur@gmail.com

# Thank you for attending!

Questions?