Multidisciplinary Health Care Management of Patients with Lymphedema and Other Cancer Related Side-Effects

Amanda Grant, PT, DPT, FAAOMPT, MTC, CLT
Objectives

- Identify the patient population at risk for developing lymphedema
- Describe the early signs and symptoms of lymphedema
- Identify musculoskeletal impairments often associated with lymphedema
- Identify prevention strategies for patients at risk for developing lymphedema
Cancer Incidence Rate

- According to the American Cancer Society
  - >1 million people are diagnosed each year
  - Approximately 1,660,290 new cancer cases expected to be diagnosed in 2013
  - Lifetime risk:
    - Male 1 : 2
    - Female 1 : 3
Cancer Rate Incidence

- According to the Journal of the National Cancer Institute\(^1\)

  - Decline in incidence rate in men
  - Stabilized incidence rate in women
Chronic Cancer

- Refers to anyone who is in a long term treatment of recurrent cancer or cancer metastases
  - Stable disease
  - Progression
  - Complete response or complete remission
  - Partial response or partial remission
Survivorship

- Improve quality of life of cancer survivors as they transition from treatment to recovery$^2$

- The National Cancer Survivorship Resource Center
  - Collaboration between the American Cancer Society and the George Washington Cancer Institute
Survivorship

Figure 1: Potential for Programmatic Action to Address Survivor and Caregiver Needs

**Psychological Needs**
- Social support, matched peer-survivor support
- Coping strategies to deal with fear of recurrence, anxiety, depression

**Medical Needs**
- Communication with physicians
- Adequate communication among physicians/specialists
- Transition back to the primary care setting

**Physical Needs**
- Managing long-term/late effects (i.e., fatigue, pain, depression)
- Interventions for health behavior change (i.e., diet, exercise, smoking cessation, screenings)

**Social Needs**
- Respite services to alleviate caregiver burden
- Financial assistance services
- Programs to ameliorate employment problems

*Need for ethnically/socially tailored materials across all programs*
Lymphedema Incidence Rate

- Approximately 30% breast cancer patients will develop lymphedema\textsuperscript{3,4}
  - Greatest rate occurs with axillary node dissection and radiation

- Lymphedema can develop immediately following surgery or anytime thereafter
Lymphedema

- Definition

“…a subcutaneous accumulation of protein-rich fluid resulting from an insufficient or blocked drainage system…”\(^5\)

- Occurs most often in the arm(s) and/or leg(s), and occasionally in other parts of the body such as the trunk and genitalia.
Anatomy Review

- Lymphatic System is a specialized component of the circulatory system.

- Retrieves lymph fluid filtered out of the circulatory system by capillaries and returns it to the venous system for circulation.\(^6\)
Components of Lymphatic System

- Thymus Gland
- Spleen
- Tonsils
- Peyer’s patches
- Lymph Nodes
  - Axillary
  - Inguinal
  - Abdominal
  - Cervical
- Lymph Vessels
Function of the Lymphatic System

- Assists venous system in the removal of lymph fluid and protein from the interstitial space
- Contributes to the immune system by producing white blood cells
Lymphedema results when the amount of lymphatic fluid exceeds the lymphatic transport capacity.
The lymphatic system originates as lymph capillaries in the spaces between cells.
Lymphatic Capillaries

- Originate as “blind ends” in tissue space
The lymphatic capillaries join to form larger lymphatic vessels.
Lymph Vessel Hierarchy

- Lymphatic Capillaries
- Pre-collectors (like lymphatic capillaries but contain smooth muscle cells and valves)
- Collectors (superficial and deep) (have three-layer wall like veins) (unlike veins they have thinner walls and valves closer together – from one to another)
- Lymph Trunks and Ducts (largest lymph vessels) (similar to collectors but have thicker walls)
Lymphatic Vessel Hierarchy

- **Thoracic Duct**
  - Largest lymphatic vessel in the body
  - Made up from the R and L lumbar trunks
  - Empties into the L subclavian vein
  - 1-5mm in diameter and 40cm long
  - Transports 75% of the daily lymphatic load
    - Approximately 2-4L daily
Lymphatic Vessel Hierarchy

- Right Lymphatic Duct
  - 2.5cm in length
  - Located in the area of the R venous angle (where R internal jugular and R subclavian vein meet)
  - Transports 25% of the total lymphatic load
- Thoracic Duct drains the L and R lower quadrants, L upper quadrant, L head and neck (75%)

- Right Lymphatic Duct drains the R upper quadrant, R head and neck (25%)
How Does Lymph Fluid Get From Capillary to Duct?

- What is the central pump for the arterial and venous circulation?

- The lymphatic system has its own internal pump (intrinsic contractility)
  - Referred to as “lymphangioactivity” or “lymphangiomotoricity”

- The functional unit is referred to as lymphangion
  - Section between valves

- Normal speed: approx 6 BPM
- Speed when stimulated: approx 20 BPM
How Does Lymph Fluid Get From Capillary to Duct?

- In addition to the intrinsic contractility lymph flow is aided by:
  - Skeletal muscle contraction (muscle and joint pump)
  - Arterial pulsation
  - Respiratory pressure changes
  - Negative pressure in central veins
  - External pressure (manual lymphatic drainage, compression garments)
  - Production of new lymph (creates back pressure)
Lymph Fluid Flow...

Lymphokinetic Motion and Pressure Gradient

Blood capillaries → Interstitial Fluid → Lymph capillaries → Lymph veins → Lymph ducts → Large circ. Veins

Higher pressure outside

Lower pressure inside

Back pressure closes minivalves
Respiration Effect on Lymphatic Flow

Inspiration
↓
Descent of the diaphragm
↓
Increased intra-abdominal pressure
Decreased intra-thoracic pressure
↓
Thoracic duct lymph “pumped” into the venous system during inspiration
Lymph Fluid

- Interstitial fluid which is absorbed from the extracellular space
- Lymph fluid carries:
  - Proteins
  - Water
  - Cells (RBC, WBC, lymphocytes)
  - Waste products and other foreign substances
  - Fat
Lymph Nodes

- Found throughout the lymphatic system
- Vary in size (2-30mm)
- Many shapes (long, oval, round, bean, kidney shaped)
- 600-700 lymph nodes in the human body
  - Majority found in abdomen, followed by head, neck, and less throughout the rest of the body
- Generally located in adipose tissue
- More afferent vessels than efferent vessels
The lymphatic vessels are joined together by lymph nodes which act as filters and empty into the right lymphatic duct or the thoracic duct.
Functions of Lymph Nodes

- Regulate fluid imbalance when excess water in interstitium
- Filtering station for noxious matter such as bacteria, toxins, and dead cells
- Production of white blood cells (lymphocytes)
Functions of Lymph Nodes cont.

- Regulates the concentration of protein in the lymph
  - \( \frac{1}{2} \) protein in systemic circulation found in lymphatic system
  - Proteins recycled by the lymphatic system
  - If higher concentration of protein in the lymphatic system then increased water is absorbed, and vice versa
How Frequently Does Lymphedema Occur?

- Affects 1% of the US population – over 2.5 million people – usually from breast cancer treatment
- Post-mastectomy: 25.5 %
- Post-mastectomy with axillary lymph node dissection and radiation therapy: 38.3 %
- Further increased with obesity and/or infection
Lymphedema

- Primary Lymphedema
  - Due to an unknown cause, but usually associated with a vascular anomaly
    - Can be present at birth, develop in puberty, or in adulthood

- Secondary Lymphedema (Acquired)
  - Due to a known cause
Primary Lymphedema

- Person is born with insufficient lymphatic system
- Unknown cause
Primary Lymphedema

- **Hypoplasia** - less than normal expected number of lymph collectors

- **Hyperplasia** - vessels are excessively dilated

- **Aplasia** - significant absence of lymph collectors

- **Inguinal Node Fibrosis** - fibrosis and degeneration of the inguinal and iliac lymph nodes
Primary Lymphedema

- Present at birth = Lymphedema congenita
- Develop in childhood = Lymphedema Praecox
  - Under the age of 35
- Develop in Adulthood = Lymphedema Tarda
  - Over the age of 35
Primary Lymphedema

- Of the primary lymphedema population
  - 87% are females
  - 13% are males

Most common age of manifestation: 17
83% developing before the age of 35
Secondary Lymphedema

- Usually results from a trauma to the lymphatic system
  - Surgery
    - Breast, gynecological, head/neck, prostate, testicular, bladder, colon
  - Radiation therapy
  - Traumatic injury
  - Seroma Aspiration
  - Lymphangitis
  - Tumor

- Cancer
- Infection
- C.V.I.
- Iatrogenic
- Obesity
- Self Induced
- Filariasis (200 million people worldwide)
Filariasis

(Filariasis bancrofti)

Mosquito Stages

8. Migrate to head and mosquito's proboscis
7. L3 larvae
6. L1 larvae
5. Microfilariae shed sheaths, penetrate mosquito's midgut, and migrate to thoracic muscles

Human Stages

1. Mosquito takes a blood meal (L3 larvae enter skin)
2. Adults in lymphatics
3. Adults produce sheathed microfilariae that migrate into lymph and blood channels
4. Mosquito takes a blood meal (ingests microfilariae)

= Infective Stage
= Diagnostic Stage
Remember….

- If lymph nodes are removed there is **ALWAYS** a risk of lymphedema
Secondary Lymphedema

There is a KNOWN cause
Differential Diagnosis

- Most important … Physical Exam and History
  - Onset?
  - Location?
  - Pain?
  - Skin Changes?
  - Other Conditions?
  - Can the swelling be changed?
  - Diagnostic Tests?
Early Signs of Lymphedema

- Tingling / Numbness
- Feelings of fullness or heaviness
- Clothing fitting tight
- Decreased active range of motion
- Visible swelling (that may come and go)
  - Especially distal swelling
Lymphedema Incidence Rate

- Increases with:
  - Amount of lymph nodes removed
  - Amount of trauma to the area
  - Radiation treatment
  - Age of patient
  - Pre-existing sedentary lifestyle
  - Obesity
Alternative Causes of Swelling

- DVT (Deep Vein Thrombosis)
- Cancer return / Malignant Lymphedema
- Lipedema
- Venous Edema
- Cardiac Edema
- Congestive Heart Failure
- Myxedema
- Complex Regional Pain Syndrome
Differential Diagnosis

- Lipedema
  - Mainly in women
  - B symmetrical swelling from iliac crests to ankles
  - Painful to palpation
  - Bruise easily
Differential Diagnosis

- **Venous Edema**
  - Non-pitting
  - Hemosiderin staining
  - Fibrosis of subcutaneous tissues
Differential Diagnosis

- Acute Deep Venous Thrombophlebitis
  - Sudden onset
  - Usually unilateral
  - Painful
  - Cyanosis- depending on severity
  - + Homan’s sign
Differential Diagnosis

- Cardiac Edema
  - Greatest distally
  - Always B
  - Pitting
  - Complete resolution with elevation
  - No pain
  - R heart insufficiency
Differential Diagnosis

- Congestive Heart Failure
  - Pitting edema
  - Orthopnea
  - Dyspnea on exertion
  - Jugular venous distention
  - B heart failure
Differential Diagnosis

- Malignant Lymphedema
  - Pain, paresthesia, paralysis
  - Central location
  - Rapid development
  - Non-healing open wounds
Differential Diagnosis

- Myxedema
  - Deposition of mucopolysaccharide substance in the skin (thyroid dysfunction)
  - Dry skin, brittle nails, thinning hair, orange colored skin
Differential Diagnosis

- Complex Regional Pain Syndrome
  - Warmth, burning, edema, sensory changes
  - Coolness, cyanosis, dry brittle nails
How Does Lymphedema Occur?

- Decreased lymph flow from lymphatic damage results in increased protein concentration in the interstitial fluid.
- With increased protein concentration, fluid is shifted into the interstitial space due to oncotic pressure.
- With fluid accumulation in the interstitial space, swelling/edema occurs in that body part.
How Does Lymphedema Occur?

- Lymphatic damage and fluid stasis leads to scar tissue/fibrosis development with collagen and fibrin deposition to vessel walls, therefore further blocking lymph flow.

- Fluid stasis increases susceptibility to infection with cycle initiated for further lymphatic damage.
Lymphedema

- Stages of Lymphedema
  - Stage 0: Pre-lymphedema/Sub-Clinical
  - Stage 1: Spontaneously reversible
  - Stage 2: Spontaneously irreversible
  - Stage 3: Lymphostatic elephantiasis
Lymphedema – Stage 0

- Impaired lymphatic system
- Amount of fluid the body can transport is reduced
- No visible/palpable edema
- Subjective complaints possible
Lymphedema – Stage 1

- Spontaneously Reversible
- Accumulation in protein rich fluid
- Limb size changes with position/elevation
- Pitting edema
- <20% change in volume between limbs
Lymphedema – Stage 2

- Spontaneously irreversible
- Non-pitting edema
- Fibrotic tissue beginning
- Elevation/position does not change limb size
- 20-40% difference in limb volume
Lymphedema – Stage 3

- Lymphostatic Elephantiasis
- Fibrotic changes in tissues
- Elephantine changes
- >40% increase in limb volume compared to the non-involved side
Types of Lymphedema Treatment

- Lymphedema is a disease. All other edemas are symptoms.

- Cure of lymphedema is not possible.
Types of Treatment Available

- **Medications:**
  - Antibiotics – decrease infection risk
  - Diuretics - decrease interstitial fluid
  - Proteases – break down interstitial proteins

- **Surgical: Not curative**
  - Excision: Charles / Homans procedure
    - Debulking of the area to remove excess tissue to decrease volume

- **Physiological:**
  - Drainage of the area via lymph to lymph or lymph to venous anastomosis
Types of Treatment

- Complete Decongestive Therapy
  - Manual Lymphatic Drainage
  - Multi-layered compressive bandaging
Effects of Lymphedema Treatment
Manual Lymphatic Treatment - Phase One - CDT

- Manual Lymphatic Drainage (MLD)
- Antiseptic Moisturizing Cream
- Low-stretch compression bandages
- Active Exercise
- Patient Education (see Phase 2)
Manual Lymphatic Drainage

- Treatment Goals
  - Improve cosmesis
  - Preserve skin integrity
  - Soften subcutaneous tissues
  - Avoid infection or lymphangitis
  - Decrease limb size
  - Avoid contracture of the involved limb
Manual Lymphatic Drainage

- Gentle manual treatment which improves the activity of the lymph vascular system.

- Re-routes lymph flow around blocked areas into more centrally located healthy lymph vessels.
Compression Bandages

- Minimally elastic bandages applied to increase pressure in extremity.
  - Reduces re-infiltration
  - Improves muscle pump
  - Helps to break up deposits of accumulated scar and connective tissue.
  - Stays in place until next MLD session.
Exercises

○ Goal: enhance muscle pump activity and promote improved venous and lymphatic return in the involved extremity

○ Employed throughout the span of the CDT treatment program including initial Phase I and Phase II.
Types of Exercise

- Flexibility/Stretching
  - minimizing tightness and the effects of
  - scarring which can block lymph flow

- Resistive
  - improve muscle power, stamina and tone
  - Greatest risk of tears/injury
  - Increases local blood flow and the production of waste products increasing load on the lymphatic system
  - Use in Conjunction with compression

- Aerobic Conditioning
  - 60% - 75% of the maximum heart rate (target heart rate)
  - Increased deep respiration (deep breathing) enhances venous and lymphatic return

Source: National Lymphedema Network
Negative Aspects of Exercise

- Blood flow is increased, possibly causing an increase in lymphatic load

- Increased muscle metabolism results in increased metabolic waste

- Improper exercise may cause inflammation and trauma
Manual Lymphatic Treatment
Phase II - CDT

- Compression Stockings/Sleeves
- Home Exercise
- Skin Care
- Patient Education
What types of compression are available in Phase II?

- Compression stocking
  - can be used for treatment and maintenance
  - 2 pairs are appropriate to maximize hygiene
  - last from 4 to 6 months
  - can be difficult to don or doff and keep in position

- Compressive wrapping
  - better flexibility for specific problem areas and for specific patients
  - patients and families can learn technique
  - allow greater activity level than pumps
  - can be time consuming to don
Available Compression in Phase II cont.

- Compression pumps
  - not adequate for primary therapy
  - do not address proximal edema
  - high cost with decreased compliance
  - less convenient for associated exercise or mobility
  - variable protocols dependent on brand and type
    - but ranges:
      - single chamber/uniform/intermittent compression: 30-60 mm Hg
      - multi-chamber/differential/sequential compression: 60-120 mm Hg
Compression Pumps
Additional Musculoskeletal Impairments

- Postural limitations
- Pain
- Scar tissue
- General deconditioning
- Stiffness
- Weakness
- Numbness
- Decreased ADL ability
Precautions with Treatment

- Slow exercise progression
- Caution of application of ice and heat
- Slow increase in depth of manual treatment
- Caution of application/placement of therapeutic devices
Lymphedema Prevention

- Protect the body part from the elements
- Protect the body part from injury
- Protect the body part from changes in pressure
- Wear compression sleeve/garment when exercising
Patient Education

- Wear protective garments for appropriate activities:
  - gardening or pruning
  - dishwashing
  - baking/cooking
  - sewing

- Immediate contact with physician if presence of infection

- Carry heavy parcels or purses on the opposite limb

- Sunscreen or long-sleeved garments for sun exposure

- Sleep with limb elevated
Patient Education

- Jewelry should not be worn on affected limb
- Insect repellent for high risk exposure
- Utilize electric razor for shaving
- Check water temperature with other limb or thermometer before immersion
- Avoid heavy lifting or repetitive movements with involved limb
- Avoid tight-fitting garments to affected limb
- Avoid climate temperature extremes
Quick Check for Risk of Secondary Lymphedema

Has the individual had cancer?

Yes

Lymph nodes removed?

No

Increased risk for developing lymphedema

Yes

Radiation or Chemotherapy?

No

Increased risk for developing lymphedema

Yes

Low risk

No

Increased risk for developing lymphedema

Visited third world country?

Yes

Increased risk for developing lymphedema

No

Low risk

Major surgery / trauma effecting lymphatic/vascular system?

No

Low risk

Yes

Increased risk for developing lymphedema
Screening and Pre-diagnosis for Cancer/Cancer Return

- Red flags and other warning signs$^{11-15}$
  - Change in BB habits
  - A sore that doesn’t heal
  - Unusual bleeding/discharge
  - Thickening lump
  - Indigestion or difficulty swallowing
  - Obvious changes in wart or mole
Screening and Pre-diagnosis for Cancer/Cancer Return

- Red flags and other warning signs cont.
  - Nagging cough or hoarseness
  - Unexplained/unintentional weight loss
  - Fever
  - Chills
  - Night sweats
  - Age >50
  - Hx of cancer
Screening and Pre-diagnosis for Cancer/Cancer Return

- Listen to the patient...
Cancer Metastases

- Predictable sites of cancer metastases
  - Bone
  - Liver
  - Lung
  - Brain
Residual Short and Long Term Impairments\textsuperscript{16–20}

- Scars and other skin changes
- Persistent fatigue
- Reproductive system changes
- Damage to muscles/musculoskeletal fibrosis
- Osteoporosis
- Hot flashes
- Altered movement pattern
Side Effects if Patient Undergoing Chemotherapy

- Cognitive impairments (chemo brain)
- Myelosuppression
- GI distress
- Peripheral and central nervous system effects
- Decreased salivation
- Alopecia
- Nail damage
- Organ toxicities
Late Effects of Cancer Treatment

- Cardiotoxicity
- Pulmonary fibrosis
- “Chemopause”
- Musculoskeletal Fibrosis
- Risk of secondary cancer
- Long lasting immune response impairment
- Permanent alterations in GI function
- Cognitive changes
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Side effects from Targeted Therapies

- Increased risk of PE and CVA
- Increased risk of Osteoporosis
- Loss of muscle mass, weakness
- Arthralgias and myalgias
- Bone pain
- Vasodilation
- Impaired healing
General Therapy Considerations

- Therapy during chemo? Radiation?
- Low level laser therapy?
- Electrical Stimulation/TENS?
- Grastin/ASTYM?
- US?
- Ice/Heat?
- Ex guidelines?
  - Workoutcancer.org
Patient Cases
Patient A
Patient A
Patient B
Patient B
Patient B
Patient C
Patient D
Patient E
Patient F
Questions???????????
Resources

Resources

Resources