Course Objectives

• Describe the pathology of lymphedema and associated risk factors.
• Articulate the steps of Complete Decongestive Therapy (CDT)
• Evaluate updated medical treatments for lymphedema

Circulatory system

• Heart
• Blood
• Arteries
• Arterioles
• Venules
• Veins
• Lymphatic system

Understand the basic design of the lymphatic system
Lymphatic Circulatory System

- One way subsystem
- Eliminates unwanted materials
- Excess Fluid

Lymphatic system

- Lymph organs
- Lymphatic capillaries
- Pre-collectors
- Lymph collectors
- Lymph Nodes
- Lymphatic trunks
- Lymphatic ducts

Lymphatic fluid

- Contains:
  - White blood cells
  - Lymphocytes
  - Fat cells
  - Water
  - Proteins
  - Waste products
Direction of lymph flow

- Begins with the lymph capillaries and pre-collectors
- Lymph collectors transport the high protein fluid to the lymph nodes
- Once proteins and waste products are processed, the lymph fluid is then transported to lymphatic trunks and ducts.

Lymph Capillary

Lymph vessels and lymph anions

- The Lymph Vessels are made of three thin layers
- The Lymph Angion is the space between each valve
Lymph node groups

- The Major lymph node collection sites are:
  - The colon where there are 100-200 lymph nodes:
  - The neck where there are 160 lymph nodes:
  - Each axilla where there are 33 lymph nodes:
  - Each inguinal where there are 11 lymph nodes and the bronchials.

Lymph node: a closer look

Thoracic Duct

- Cysterna Chyle
- Lumbar trunks
- Intestinal trunk

Thoracic Duct

- After leaving the lymph nodes, the largest lymphatic collecting vessels converge to form lymph trunks
- These trunks drain large areas of the body


2-4 liters daily
Lymph circulatory structures

- Respirations
- Smooth Muscles
- Valves

Right Lymphatic duct

- Drains fluid from R upper quadrant.
- 1.25 cm in length

Lymphatic system video

Hydrostatic and colloid osmotic pressure
High output failure

- Recommended treatment:
  - Apply ice
  - Compression
  - Exercise and
  - Elevate the limb above the heart

Summary

- Direction of lymphatic flow
- Lymph fluid and movement
- Lymph node distribution
- Lymphatic termination
- Starlings law in circulation
- High and low output failure

Low output failure

- Complete Decongestive Therapy (CDT)
- Skin Care
- Manual Lymph Drainage (MLD)
- Layered short stretch compression bandaging
- Limb Clearance exercises

Create a visual representation of the lymph physiology at the capillary bed
Lymph Physiology

Money Analogy

- You receive your salary check.
- The money goes into the bank.
- While in the bank the 10% of the money goes to pay debt.
- Money going to pay debt is eventually absorbed back into the economy.
- Ninety percent goes to pay household and spending expenses.
- Eventually being absorbed back into the economy.

Fluid balance in the body

Costco Lines Analogy

- You enter into Costco circulation.
- The money goes into the bank. You shop and the check out.
- You enter a long line for check out.
- You send your friend to the front of the line and find there are many short lines and two long lines.
- You can't move into the short lines because it's not your turn to choose which line to go to.
- Your friend goes to the front and directs traffic, filling up short lines.
- Now your line moves more freely. You check out in minutes.
Freeway Analogy

• Without car accidents, all cars can move and get on and off the freeway without any problem.

• However, if there is a car accident on the freeway, traffic slows down or has to be re-routed.

• At first the car sits in the traffic jam and it is not getting to its destination.

• Then the car sees an exit ahead and gets off at the exit to take another route, reaching its destination.

Freeway Analogy Explained

• When there is blockage in the lymph vessels, either due to damaged lymph nodes (car accident) or lymph vessels (traffic flow), the car (waste products) needs to exit the freeway and get there another way (manual lymph drainage).

Identify, stage and classify lymphatic dysfunction.

What is Lymphedema (LE)

• Edema and inflammation occurs in the dependent tissues due to an increase in blood circulation in which the lymphatic system is unable to transport the fluid to a designated region.
Identifying lymphedema

- Lymphedema can be congenital (Primary) or due to a secondary cause.
- If congenital, the person is born with faulty lymphatic vessels and/or lymph nodes.
- If secondary, the lymphatic system becomes damaged due to another cause such as tissue trauma that damages the lymphatic system.

Primary Lymphedema

- Milroy's Disease begins at infancy, LN's form abnormally
- Meige's Disease-lymphedema praecox, occurs after 13 y/o. Lymph vessels form without the valves.
- Lymphedema Tarda-occurs after 35 y/o.

Primary Lymphedema

- Usually determined when a cause has not been identified.
- The four types of etiologies are:
  - Hypoplasia, a reduced amount of lymphatic collectors and a decreased lymph vessel diameter;
  - Hyperplasia, an increased diameter of lymphatic collectors;
  - Aplasia, absence of lymphatic system components;
  - And Kinmonth syndrome, inguinal lymph node fibrosis.

Secondary Lymphedema

- Due to a known insult to the lymphatic system.
- Lymph capillaries, lymph vessels or lymph nodes are removed, blocked, fibroses or damaged to the extent that the lymphatic system is unable to manage the lymph load.
- Fluid accumulates in a certain region of the body.
Secondary Lymphedema

- Damaged lymph vessel or node from surgery.
- Radiation can cause scarring and inflammation of LN or LV, restricts flow of fluid.
- Blocked lymph vessel-tumor or parasite can block LV and flow of LF.
- Infection restricts the flow of lymph fluid.

Progression of Lymphedema

Stage II

- Scarring and thickening of connective tissue.
- Limb becomes asymmetrical.
- Elevation no longer returns limb to normal.

Stages of Lymphedema

- Four stages
  - 0
  - I
  - II
  - III
Stage III

- Trophic changes in the skin: papillomas, hyperkeratinosis, worsening fibrosis as skin becomes rigid due to excess protein rich fluid
- Lobular folds are present and potential for non-healing wounds.

Classifications of Lymphedema

- Minimal
  - 3 cm difference between both limbs
  - <20% increase in limb volume
- Moderate
  - 3-5 cm difference between both limbs
  - + Stemmer's sign
  - 20-40% increase in limb volume
- Severe
  - >5 cm difference between both limbs
  - + Stemmer's sign
  - >40% increase in limb volume

Mathematical formula calculating the circumference of a limb:

\[ V = \frac{1}{3} \pi r^2 h \]
Understand how to use Complete Decongestive Therapy to treat Lymphedema

Complete Decongestive Therapy
- Two phase treatment
  - Decongestive phase 2-6 weeks
  - Self care phase-life time
- Skin care
  - Prevent infection
  - Manual Lymph Drainage
  - Transport lymph fluid to functional regions
- Short stretch bandaging
  - Maintain tissue compression to support lymphatics
  - Compression garments used during self care phase
  - Limb clearance exercises
    - Performed with compression
    - Aerobics increases lymph tenfold
    - Stimulates the muscle joint pump
  - Diaphragmatic exercise

Symptoms of Lymphedema
- Swelling
- Loss of mobility
- Numbness
- Heaviness
- Infections
- Impaired wound healing
- Fibrosis
- Papillomas
- Hyperkeratinosis

Lymph Transport Control
- Arterial pulsation
- External pressure
- Muscle & joint pump
- Respiratory pressure changes
- Negative pressure in central veins
### Skin Care Prevention

- Lymph transport that is slow and becomes stagnant is a bacteria culture medium for infection.
- Protect your first line of defense

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<th>Manual Lymph Drainage</th>
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<td>• Changes mechanoreceptors of the skin</td>
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<td>• Dilate lymph collectors</td>
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<td>• Increases lymph angion contraction</td>
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<td>• Increase capillary filtration</td>
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<td>• Increased lymphangiomotoricity</td>
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<td>• Increase peristaltic motility</td>
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<td>• Increase blood volume</td>
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<td>• Decrease reflux and pooling</td>
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<td>• Increase reabsorption</td>
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<td>• Increase microcirculation</td>
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<td>• Increases lymph vessel motility</td>
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### Skin Care Prevention

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<td>Obesity</td>
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<td>Repetition exercises</td>
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<td>Restrictive clothing</td>
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<td>Pleasure</td>
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Right UE lymphedema

- Neck
- Breathing
- Abdomen
- Clear trunk LN groups
- Make a pathway along trunk
- Upper arm, lower arm, hand

Short Stretch Bandaging

- Reduces capillary filtration
- Increases muscle joint pump
- Prevents re-accumulation
- Softens indurated tissue
Limb Clearance Exercises

- Performed with compression
- Aerobic activity
- Abdominal breathing
- Active range of motion exercises
- Functional activities

Compression Garments

- Reduces vein diameter
- Decreases blood volume
- Prevents refills and pooling
- Improves diffusion
- Increases pressure
- Increases reabsorption
- Improves microcirculation
- Use a gradient pressure
- Compression strength
Evaluate updated medical treatments for lymphedema

Effectiveness of Decongestive Lymphatic Therapy in Patients with Lymphedema Resulting from Breast Cancer Treatment Regardless of Previous Lymphedema Treatment.
Bozkurt et al 2017

• Compare effectiveness of DLT from those who had no lymphedema treatment compared to those who previously had lymphedema treatment.
• Outcome measures were: Percent change in volume measured by perimeter after DLT
• DLT significantly reduced arm volume in both groups.
• DLT reduced limb volume significantly with post mastectomy LE, regardless of previous lymphedema therapy.

Effectiveness of the treatment-phase of two-phase complex physiotherapy for the treatment of extremity lymphedema
Ritsu et al. 2007

- 82 Japanese women with lymphedema
- Volume measurements prior/post CDT
- Duration: UE’s 3-26 days, LE’s 2-35 days
- Reduction: UE’s 58.9%, LE’s 73.5%
- The degree of LN dissection influenced the rate of edema reduction
- CDT consisting of two phase treatment program was clearly effective.

Referring to a Lymphedema Specialist

- www.clt-lana.org
- Look4LE App
- Contact primary care physician
- Hospitals setting for in network specialists
ALL NEGATIVITY

is caused by an accumulation of psychological

time and denial of the present. Unease, anxiety, tension,

stress, worry — all forms of fear — are caused by too

much future, and not enough presence. Guilt, regret,

resentment, grievances, sadness, bitterness, and all forms

of nonforgiveness are caused by too much past,

and not enough presence.

Eckhart Tolle