

Evidence-based Screening and Treatment of Lymphedema

KANSAS PHYSICAL THERAPY ASSOCIATION
FALL CONFERENCE – OCTOBER 2, 2010

Lisa VanHoose, PT, PhDc, CLT-LANA, WCC
University of Kansas – Medical Center Campus

Course Objectives

- Describe the anatomy and physiology of the lymphatic system based on current evidence.
- Screen for various peripheral and trunk edemas and complete a thorough and efficient physical therapy evaluation.
- Demonstrate an understanding of the contraindications and indications for complete decongestive therapy.
- Demonstrate an understanding of evidence-based utilization of various compression, electrotherapeutic, LASER and ultrasound modalities in the treatment of lymphedema.

Agenda

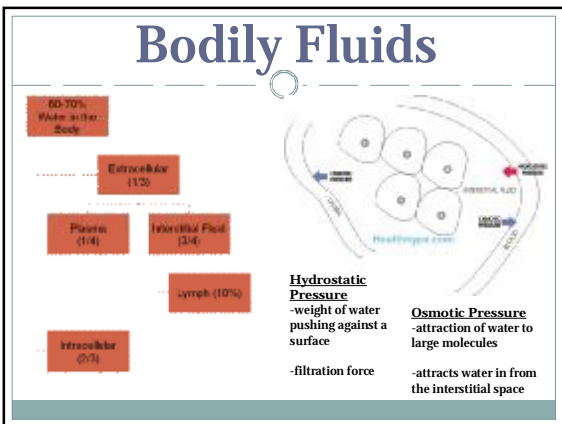
- 2:00-2:05pm Introductions, Objectives and Agenda
- 2:05-2:25pm Anatomy and Physiology of the Lymphatic System (Objective 1)
- 2:25-2:50pm Screening for Edemas (Objective 2)
- 2:50-3:00pm Break
- 3:00-3:10pm Case Study Drill (Review of Edemas)
- 3:10-3:30pm Evaluation using the ICF model (Objective 2)
- 3:30-3:50pm Interventions – Lab Format (Objectives 3 & 4)
 - Electrotherapy
 - LASER
 - Ultrasound
- 3:50-4:00pm Break
- 4:00-4:10pm Case Study (for group presentations)
- 4:10-5:00pm Interventions – Lab Format (Objectives 3 & 4)
 - Complete Decongestive Therapy
 - Interactive Phase
 - Maintenance Phase
- 5:00-5:10pm Break
- 5:10-5:35pm Case Studies and Group Presentations (Objectives 1-4)
- 5:35-5:45pm Q&A

ANATOMY AND PHYSIOLOGY

Lymphedema

“Chronic disorder characterized by the abnormal accumulation of lymph fluid in the tissues of one or more body regions”

O'Sullivan 2007



Lymphatic Terminology

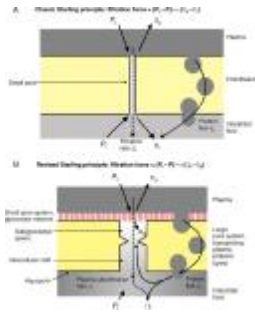
Lymph:

- Leakage of blood plasma from capillaries
 - | Normal process
 - | Lymphedema – abnormal accumulation
- Clear fluid
- Component of interstitial fluid

Lymphatic load:

- Protein load (150-200g)
- Water load (transport capacity)
- Cell load
- Fat load
- Hyaluronan

Comparison of traditional and revised views of the endothelial semipermeable membrane and the forces acting on it.

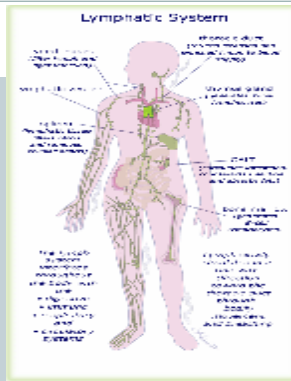


Levick J R, Michel C C Cardiovasc Res 2010;87:198-210

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- Consist of lymph vessels and organs
- Vessels conduct lymph towards the venous system
- Lymph organs
 - | Thymus
 - | Lymph nodes
 - | Spleen
 - | Tonsils
 - | Lymph follicles of mucous membrane
- Runs parallel to venous system

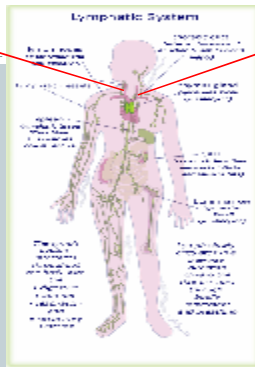


www.merck.com

Lymph Vessels

- Originate in the interstitial space (capillary exchange)
- Empty into venous angles
- Lined with endothelial layer
- **Capillaries**
 - | Wider and more irregular than blood capillaries
 - | No valves
 - | **Lymph can be shifted by manipulation**
 - | No smooth muscle
 - | Highly permeable to proteins and macromolecules
- **Precollectors and collectors**
 - | 3 layers, similar to venous walls
 - | Thinner walls, larger lumens
 - | Valves, more than veins
 - | **Unidirectional flow**
- **Lymph trunks**
 - | Thoracic duct – lower half of the body
 - | Multiple upper extremity, cervical, upper truncal lymph trunks

Right lymphatic duct connects with right jugulosubclavian area and drains 1/4 of the body (right upper quadrant)



Thoracic duct connects with left jugulosubclavian area and drains 3/4 of the body (left upper quadrant and the lower quadrants)

Lymphatic Transport

- Lymphangion contraction
- A/PROM
- Arterial pulsation (deep vessels)
- Massage
- Respiration

Lymphatic Functions

- Removal of waste and excess fluids from body tissues
- Production of immune cells
- Absorption of fatty acids
- Transportation of chyle

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



Screening for Edemas

Screening, Assessments and Evaluations??

Screening

- Identification of a condition
- Yes or No
- Will typically involve little assessment

Assessment

- Condition focused tests
- Specify the condition – differential diagnosis

Evaluation

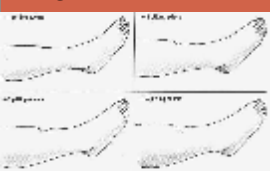
- Complete process including the medical professional and consumer
- Medical history
- Patient interview
- Assessment, examination results
- Goals

Screening

- Need to use at least one to identify edema
- Each will serve as an assessment tool for the evaluation
- **Physical Appearance**
 - | Does it visually appear swollen?
 - | **UNILATERAL VS BILATERAL (Appearance and severity)**
 - | Is there pitting edema?
 - | Is cellulitis a concern?
 - | Is deep vein thrombus (DVT) a concern?
 - | Skin changes
 - Color, texture, temperature
- **Stemmers Sign**
- **Measurements**
 - | Circumferential measurements
 - | Volumetric measurements
 - | Bioimpedance
 - | Tissue dielectric constant
 - | Perometry

Physical Appearance

Pitting Edema



International Society of Lymphology

- | 0 – ¼ = 1+ mild
- | ¼ to ½ = 2+ moderate
- | ½ to 1 inch = 3+ severe
- | > 1 inch = 4+ very severe

Cellulitis

- **Skin infection caused by bacteria**
 - | Redness or purplish color
 - | Pain
 - | Warmth
 - | May appear tight or stretched
 - | May have hair loss and joint stiffness due to edema
 - | **NEEDS MEDICAL ATTENTION**

Stemmers Sign



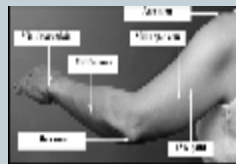
- Attempting to tent the skin at the base of the second toe or finger
- Positive – if unable to lift the skin
 - | Sensitivity is good
- False negative is possible
 - | Specificity is poor

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

Neil Pillar

Measurement Tools

- **Circumferential**
 - | Fixed distances from the middle finger or **anatomical landmarks**
 - | **Intra-rater reliability** better than inter-rater reliability with upper extremity edema
 - Deltonbe et al, Lymphology. 2007 Mar;40(1):26-34
 - | Use truncated cone formula to calculate volume
 - $V = h(C_1^2 + C_2 + C_3 + C_4^2) / 12\pi$
- **Volume**
 - | Gold standard – water displacement
- **Don't underestimate the consumer's reports of firmness or tightness**
 - | Correlated with circumferential and bioimpedance measurements of edema (Ridner et al, 2007)

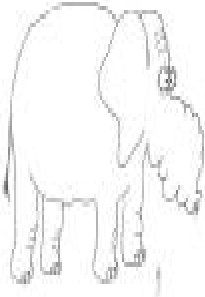


Taylor et al. PHYS THER. Vol. 86, No. 2, February 2006, pp. 205-214

Table 5.4. The upper extremity edema index (UEEI) is a composite score of upper extremity circumference measurements at the wrist, elbow, and midline. The UEEI is calculated as follows: $UEEI = (Wrist + Elbow + Midline) / 3$.

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)
- **Tissue dielectric constant**
 - | Measurement of high frequency microwaves
 - | Limited information on normal values (Mayrhofer, Skin Res Technol. 2010 Feb;16(2):16-22) but BMI and age can affect measurements
- **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

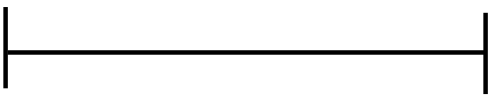


It's edematous, now what???

DIFFERENTIAL DIAGNOSIS – ASSESSMENT OF THE EDEMA

Edema Spectrum

ACUTE **CHRONIC**




ACUTE INJURY CVI LYPHHEDEMA

Normal Inflammatory Cascade

I. Levejay

International Society of Lymphology Staging



- **Stage 0**
 - | Brief swelling in hand
 - | Subclinical
 - | 3% volume change (Stout et al. Cancer, Volume 112, Issue 12, pages 2809-2819, 15 June 2009)
- **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 (Fai et al. AJN, American Journal of Nursing, July 2009, Volume 109 Number 7, Pages 48-54)
- **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

The Diagnosis and Treatment of Peripheral Lymphedema. 2009 Consensus Document of the International Society Of Lymphology. Lymphology 42, June 2009, pages 53-54.

Skin changes



Hyperkeratosis, papillomas and hemosiderin staining



Hemosiderin staining and induration

Dependent Edema

- Bilateral
- Symmetrical involvement
- Pitting
- Foot involvement
- Stemmer negative
- Soft edema
- Typically no ulcerations
- Elevation effective

Venous Insufficiency

- Bilateral
- Symmetrical
- Soft edema
- Quick refill with pitting attempts
- No foot involvement
- Cellulitis
- Skin discoloration – hemosiderin
- Hx of CHF
- Stemmer negative
- Elevation effective
- Can also have phlebo-lymphedema

Cardiac Edema

- Bilateral
- Symmetric
- Soft edema
- Quick refill with pitting attempt
- Elevation effective
- Discoloration, occasionally
- Hx of CHF
- Stemmer's negative

Lipedema

- Bilateral
- Primarily affects females
- Associated with obesity
- Symmetrical
- Soft edema
- Painful
- Minimal pitting
- Elevation ineffective
- Stemmer negative

EVALUATION: USING THE ICF MODEL

ICF

- 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 domains
 - | Body functions and structure
 - | Activity and participation
 - | Environmental factors



ISBN: National Center for Health Statistics, Room 979, 1225
Belmont Road, Hyattsville, MD 20781, USA
Center Print Product

ICF and the Edema Evaluation

- Demographics, Parts 1-4a serve as objective sections of the typical evaluation
- Demographics
 - | Medical Diagnosis
 - Pain in limb
 - Swelling in limb
 - Lymphedema
 - Muscle weakness
- 1a. Impairments of Body Functions
 - | Extent of the impairment
 - b280 Pain
 - b640 Sexual functions
 - b7. NEUROMUSCULOSKELETAL AND MOVEMENT RELATED FUNCTIONS
 - b8. FUNCTIONS OF THE SKIN AND RELATED STRUCTURES
 - Other Impairments: edema, lymphedema

1b. Impairments in Body Structure

- Extent of the impairment
- Nature of the change in structure
 - s7. STRUCTURE RELATED TO MOVEMENT
 - s8. SKIN AND RELATED STRUCTURES
 - Any other body structure
 - Any other structure affect by the edema – eye, neck, genitals

2. Activity Limitations and Participation Restriction

- Extent of participation restriction
- Extent of activity limitation

3. Environmental Factors

- Identify as barriers or facilitators

4. Other Contextual Information

- 4.1 Use as an assessment area
 - Write a short summary of impairments
 - Manual muscle tests
 - ROM and other special tests
 - Edema, wound and skin measurements
 - Results from additional diagnostic tests
 - Lymphangiogram
 - Lymphoscintigraphy
- 4.2 Captures personal factors and goals

The document lacks a true goal and POC section but could be incorporated in section 4.1

<http://www.who.int/classification/icf>

INTERVENTIONS

ACKNOWLEDGEMENTS:
LORRAINE LOVEJOY (EDEMA AND POC DIAGRAMS)
BARBARA FELDMAN (BANDAGING INSTRUCTIONS)

Treatment

ACUTE

CHRONIC

RICE	Self MLD QID-QH+ & Clinical MLD
Short-term compression Massage	Lifelong compression garments Manual lymph drainage
Within 24hrs – 1week Dynamic failure	1 week – 3months "Watchful waiting" Surgical edema
	> 3 months Mechanical or combined failure

How to Approach Edema

- Determine Etiology of Edema
- Rule-out contraindications to RX
- Determine willingness for lifelong RX
- Determine RX needed
 - | Greater Edema/fibrosis=more intense RX
 - | Prevention=more education but more susceptible to be non-compliant
- Determine willingness/ability for RX
 - | Cognitive/physical ability for self RX
 - | Need for caregiver training

Development of POC



Complete Decongestive Therapy

- **Gold Standard**
- **Cochrane Breast Cancer Group. Complete decongestive therapy for lymphedema following breast cancer treatment, July 2009.**
 - | Manual lymph drainage
 - | Compressive bandaging/garments
 - | Therapeutic exercise
 - | Skin care and hygiene
 - | Patient education

Phases of CDT

- **Phase 1 (Intensive)**
- **Objective: Volume reduction**
- **Frequency varies**
 - | Daily – original protocol (Ko et al, Arch Surg, 1998 Apr;133(4):452-8)
 - | Two-three times a week (Hollgreff, Phys Ther, 2006 Aug;86(8):1128-30)
- **Skin care**
 - | MLD
 - | Compression bandages
- **Exercise**
- **Phase 2 (Maintenance)**
- **Objective: Preserve loss**
 - | Compression therapy (stockings, pumps)
 - | Physician visits
 - | Skin Care
 - | Self MLD
 - | Exercise

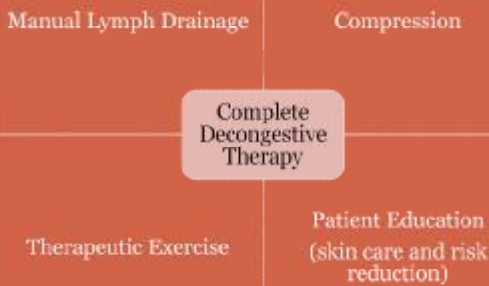
Mayrovitz, Lymphat Res Biol. 2009;7(2):101-8

Other Interventions

- **Electrotherapy**
 - | Pubmed Search revealed few studies related to the topic
 - | 1994 animal study using HVPC showed an increase in the uptake of proteins into the lymphatic vessels but no change in edema (Cook et al Phys Ther, 1994 Nov;74(11):1040-6)
 - | Theory: HVPC reduces the leakiness of the vessels
- **LASER**
 - | FDA approved use by a trained therapist
 - | Need to confirm FDA approval: Riancorp LTU-904 laser therapy unit
 - | Cold laser – be careful of heat from lights
 - | Decrease in volume has beneficial effects on ROM and strength J (Ahmed et al, Surg Res, 2010 Apr 18; Dirican et al, Support Care Cancer, 2010 May 6)

Other Interventions

- **Ultrasound**
 - | Primarily used for diagnostics
 - | **Filariasis** (Rocha et al. Mem Inst Oswaldo Cruz. 2009 Jul;104(4):621-5)
- **Cryotherapy**
 - | Research is scant but current theory is that cryotherapy slows lymphatic flow (ANTEDOCTAL)
- **Thermotherapy**
 - | Okhuma showed reductions with combined treatment of magnets, vibration and heat (Lymphology. 2002 Jun;25(2):87-90)
 - | Van der Veen reported no change in lymphatic flow but increases in venous return with electromagnetic diathermy (Lymphology. 2000 Mar;23(1):42-4)
 - | Thermal ultrasound showed some promise in softening tissues (Johnson et al. Lymphology. 1993 Sep;16(3):228-30)
- **Aquatics**
 - | Research is lacking but antedoctally consumers have seen volume reduction possible due to changes in fluid dynamics or physical activity



Precautions

- Bronchial asthma
- Hyperactive thyroid
- Menstrual cycle
- TB
- Cat scratch fever
- Toxoplasmosis
- Nevus
- First trimester of pregnancy
- Treated cancer
- Low BP

Contraindications

- Malignant diseases
- Acute infection
- DVT
- Cardiac edema
- Renal failure
- Radiation fibrosis (local)
- Peripheral Arterial Disease (compression)

Manual Lymph Drainage

- **Certification**
 - | This is a topic of much debate
- **Manual manipulation of the lymphatic vessels**
- **Enhanced lymphangion contraction**
- **Objective**
 - | Increased lymph vasomotoricity
 - | Mobilization of fluid
 - | Softening of indurated tissues

Manual Lymph Drainage

1. Start with deep breathing.
2. Clear the venous angle.
3. Stimulate the lymph node bed that will receive the fluid
4. Move fluid from the proximal segment first. Bring the fluid across to the unaffected lymph node bed before progressing to the next segment.
5. Perform on the anterior and posterior surfaces.
6. End treatment with deep breathing exercises.

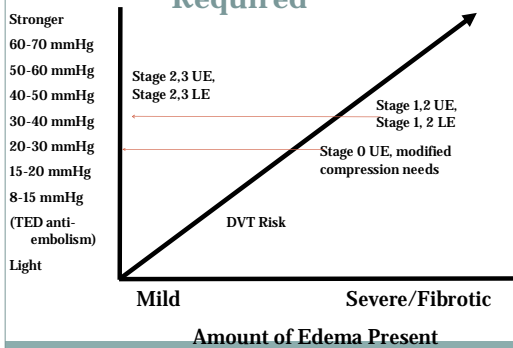
Manual Lymph Drainage Strokes

- **Stationary Circles**
 - | Continuous spirals
 - | Neck, face and lymphatic nodes
- **The Pump Technique**
 - | Palms down on the skin
 - | Limbs
- **The Rotary Technique**
 - | Palms facing down
 - | Apply and lessen the stroke pressure with wrist movement
 - | Flat surfaces
- **Scoop Strokes**
 - | Palms facing up
 - | Pressure applied with a twisting strokes
 - | Limbs

Compression Bandaging/Garments

- Reduces ultrafiltration pressure
- Increases venous and lymphatic drainage
- Improves venous pump
- Softens fibrotic tissue
- Maintenance of MLD/positioning results
- Improves hemodynamic effects
- Increases reabsorptive surfaces

Amount of Compression Required



Unique Compression Options

- **Genital**
 - | Spandex
 - | Feminine hygiene items
 - | Foam
- **Neck**
 - | Construction winter face protectors (mask)
 - | Kinesiotape
- **Trunk**
 - | Commercial athletic compression garments
 - | Large tubigrip (layered)

Pumps and Orthotics

Compression Pumps

- Multiple chambers, intermittent pressure compression
- Time extensive 1-4 hours/day
- User-friendliness varies
- Risk of genital swelling
- Lack of truncal clearance
 - | Can be added to CDT (Siderovskiy, Lymphology, 2009 Dec;42(4):188-94)
- Reimbursed by most insurance

Orthotics

- Alternative to bandaging and garments
- User-friendliness



Therapeutic Exercise

- Enhanced lymphatic flow
- Deep breathing – best
 - | Encourage hourly or multiple times a day
- Deliberate movements
 - | Aerobic and resistance exercise
 - | Katz et al. Arch Phys Med Rehabil. 2010 Jul;91(7):1070-6
 - | McClure et al. Am J Occup Ther. 2010 Jan-Feb;64(1):59-72
 - | Markes M, Brockow T, Resch K.L. Exercise for women receiving adjuvant therapy for breast cancer. Cochrane Database of Systematic Reviews 2006, Issue 4
- With compression therapy
 - | Bandages
 - | Garment
- ACSM Exercise Guidelines for Cancer Survivors
 - | Progress in small increments
 - | Evaluate sensation, strength and endurance

Patient Education

- Must be vested in care
- Lymphedema is a chronic disease with no cure
- Educate on disease management
- Care contracts

- Skin care
 - | Do not use alkaline soaps
 - | Use pH neutral or acid buffered cleansers
 - | Keep skin clean and moisturized
- Risk reduction
 - | National Lymphedema Network Position Papers
 - | KOMEN
 - | American Cancer Society (ACS)

Risk Reduction (KOMEN and ACS)

- Treat infections of the affected arm and hand right away.
- Wear gloves when doing house or garden work.
- Keep skin clean and well-moisturized.
- Use the unaffected arm when having blood drawn, getting injections or having blood pressure taken.
- Avoid sunburn and excess heat from saunas, hot baths, tanning and other sources.
- Do not cut nail cuticles.
- Use insect repellent when outdoors.
- Avoid injuries, including scratches and bruises, to the at-risk arm.
- Rest the at-risk arm in an elevated position (above the heart or shoulder).

RX: Stage 1

Evaluation: Stage 1 Lymphedema

- Baseline Measurements
- Instruct in self/partner MLD technique
- Instruct in Infection S&S Actions Necessary
- Instruct in cardiovascular/strengthening HEP
- Instruct in prevention of overuse
- Compression: Trial of OTC or Tensogrip
- No change in measurements-progress to clinical RX
- Instruct in HEP of Alignment pathology RX

RX: Stage 2 & 3

Evaluation: Stage 2 & 3 Lymphedema

- Baseline Measurements/photos/weight
- Instruct in self/partner MLD technique/bandaging
- Instruct in Infection S&S Actions Necessary
- Instruct in cardiovascular/strengthening HEP
- Clinical MLD & bandaging/chip bags (fibrosis)
- Continue CDP until girth stable-garment obtained
- Instruct in HEP of Alignment pathology RX pm
- Instruct in lifelong treatment/troubleshooting

RX: Lifelong

Evaluation: Lifelong

- Repeat Baseline Measurements/photos/weight
- Review self/partner MLD technique/bandaging
- Instruct in Infection S&S Actions Necessary
- Instruct in cardiovascular/strengthening HEP
- Review prevention of overuse
- Review garment failure (inadequate)
- Review frequency of garments/assist with garment
- Instruct in HEP of Alignment pathology RX pm

FINAL CASE STUDY

Return to Group

- Review Case

Prepare a short summary of ICF eval

- Prepare a short description of POC (including exercise plan with frequency) and a demonstration of compression device

○

QUESTIONS???

Lisa VanHoose
lvanhoose@kumc.edu

Pictures not identify in the presentations are from images. Md or personal clinical practice
