Lower Extremity Edema: Lymphedema, Chronic Venous Insufficiency and Beyond

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Learning Objectives

• Discuss the initial evaluation and diagnosis of a patient with chronic lower extremity edema

• Understand Venous Hemodynamics and Lymphatic Physiology

• Discuss Differential Diagnosis of Leg Edema

• Management options for Lymphedema

• Management of Leg Edema in Chronic Venous Disease
Leg Edema Definition

- Edema is defined as a palpable swelling caused by an increase in interstitial fluid volume.

- Edema, other than localized edema, does not become clinically apparent until the interstitial volume has increased by 2.5 to 3 liters.
Chronic Leg Edema Differential Diagnosis

- Chronic Venous Disorders
  - Chronic Venous Insufficiency
  - Obstructive Venous Disease
  - Pelvic Congestion Syndrome
- Lymphedema
- Idiopathic Venous Edema
- Lipedema
- Reflex Sympathetic Dystrophy
  - Complex Regional Pain Syndromes
- Systemic Causes
  - CHF
  - Chronic Kidney Disease
  - Chronic Liver Disease
  - Hypoproteinemia
  - Pulmonary Hypertension / Sleep Apnea
  - Drugs: Ca Channel Blockers, Steroids, NSAIDS, Progesterone
Causes of Leg Edema

• Most Likely Cause of Leg Edema over age 50 is **Chronic Venous Insufficiency**
  • Venous Insufficiency affects unto 30% of the population
  • Heart Failure affects only approx 1%

• CVI with Leg edema may be present with or without Varicose vein or Skin Changes

• Diagnostic Ultrasound is the Modality of choice for initial evaluation
Duplex Ultrasound Evaluation

Lt gsv
Investigation in Patients with Chronic Venous Insufficiency and Edema

• Is there Venous Insufficiency?

• Is it because of Reflux, Obstruction or Both?

• What is the Severity of Reflux?

• What is the Severity of Obstruction?

• Is there Calf Muscle Pump Failure due to Musculoskeletal Disease?

• Does the Findings match the Clinical Picture?
Venous Hemodynamics

- Cardiac Output 5L/min
- 60% of Blood Volume resides in the Venous system
  - 25-50% of this is Small Post Capillary Venules
- Venous return dependent on
  - Central Pump
  - Pressure Gradient
  - Calf Muscle Pump
  - Venous Valves
Lymph Capillaries

Lymph Capillaries in the Tissue Spaces

- Tissue cells
- Lymph capillary
- Arteriole
- Tissue fluid
- Tissue spaces
- Venule
- Lymphatic vessel
Starling's Law of Capillaries

- **Blood flow**
  - Larger hydrostatic pressure = 35mm
  - Smaller osmotic pressure = 25mm
- **Capillary wall**
  - Net flow out of capillary into tissues = 10mm
- Smaller hydrostatic pressure = 15mm
- Larger osmotic pressure = 25mm
  - Net flow into capillary = 10mm
Figure 3.1 The relative pressures generated by dynamic (cardiac pump) and hydrostatic (positional) influences are illustrated in this schematic. The figure has been standing motionless with the dependent veins filling by gravity. Upper extremity pressures vary with position of the arm. From Meissner et al. DP, dynamic pressure; Ht, height; HP, hydrostatic pressure; RA, right atrium.
Evaluation of Patient with Chronic Venous Insufficiency

• LEVEL 1
  • Clinical Exam
  • ABI
  • Handheld Doppler

• LEVEL 2- Non Invasive
  • Duplex Ultrasound
    • Lower Extremity
    • Abdomen and Pelvis
  • Air Plethysmography
  • CTV/MRV

• LEVEL 3
  • Venogram
  • Intravascular Ultrasound
  • Direct Pressure Measurements
Modality Based on CEAP

- **CEAP 0/1 - Spider Veins** Level 1
- **CEAP 2 - Varicose Veins** Level 1 and 2
  - Unusual Sites - Buttock/Vulvar - Pelvic USG and/or Level 3
- **CEAP 3 - Edema** Level 2
  - Consider Level 3 in selected cases
- **CEAP 4-6 Skin Changes/Ulcer** Level 2
  - Consider Level 3 in selected cases
Venous Filling Index

- VFI (ml/sec)
  - ≤ 2 - Normal
  - > 2 - Reflux

Ejection Fraction

- $\text{EF} = \frac{\text{EV}}{\text{VV}} \times 100\%$
  - ≥ 60% - Normal
  - < 40% - Poor Muscle Calf Function

Residual Volume Fraction

- $\text{RVF} = \frac{\text{RV}}{\text{VV}} \times 100\%$
  - < 35% - Normal
  - RVF ≈ AVP
Figure 8. Schematic illustration of the superficial venous pressure at rest, and during ambulation. The ambulatory venous pressure (AVP) represents the lowest mean pressure during walking at the site of measurement, and the recovery time (RT) is the time interval between the termination of walking until the vein pressure reaches the pressure level at passive dependency. In healthy subjects, AVP at the distal calf is about 30 mm Hg and RT is 20–30 s.
Treatment Modalities for Superficial Venous Reflux

- Endovenous Ablation
  - Radiofrequency
  - Laser Ablation

- Sclerotherapy

- Phlebectomy

- Compression Stockings
Lymphedema

- Lymphatic system impairment resulting in edema
- 149 million affected worldwide
  - Lymph fluid = water, protein, large molecules
- Arms, legs, head, neck & abdomen

Formation of lymph and fluid compartments. Figures courtesy of Lippincott Williams & Wilkins, Copyright 2004.
Lymphatic System

• Function:
  • To transport lymph fluid
  • To assist the immune system
  • To assist the digestive system

Etiology of Lymphedema

- **Primary:**
  - appears early in life
  - Congenital Malformations
    - Meige’s Disease: Avalvular Lymphatics
    - Milroy’s Disease
    - Lymphedema Tarda

- **Secondary:**
  - appears later in life
  - Acquired
    - Cancer & Treatments
    - Infections (Bacteria & Filariasis)
    - Trauma or Surgery
    - Deep Venous Thrombosis
    - Congestive Heart Failure
    - Lipedema
    - Chronic Venous Insufficiency
Lymphedema Praecox

• Appears between puberty and 35 years of age
• Represents 75% of all primary cases
• Usually female (4:1)
• Usually unilateral
• Symptomatic management
• Normal life is the rule

Lymphedema Tarda

• Rarest form
• 10% of all cases
• Occurs after age 35
• May be bilateral
• Unknown cause
• May be a minor incident
Secondary Lymphedema

• Filarialis is the more common than primary lymph edema in tropical countries.

• In Western Countries- Surgery or Radiation therapy is a major source for secondary lymphedema.
Phlebolymphedema

- 20-30% of patients with advanced Chronic Venous Disease have lymphedema
  - Overload
  - Recurrent cellulitis
- CVD is more prevalent - hence this should be the predominant cause for lymphedema
- Lymphangiography cannot distinguish between primary and secondary lymphedema
- Venous investigations are seldom done
  - Venous Duplex does not evaluate iliac lesions
  - Venography may miss up to 50% of correctable venous pathology
  - IVUS not routinely used
Venous and Lymphatic Edema

• Diagnosis and treatment of lymphedema. Raju et al JVS 2011

• Clinical features are poor guide
• Lymphangiography was not helpful in differentiating pri vs sec lymphedema
• Venography 61% sensitivity
• IVUS sensitivity of 88% for >50% stenosis
• Iliac Venous Stenting improved swelling, Pain, QOL score
  • Compared two groups – Impaired Lymphangiogram and normal
    • Complete relief - 16% Vs 44%
    • Partial Relief – 45% and 66%
Signs and Symptoms

• Swelling
• Heaviness
• Tightness
• Pain & discomfort
• Skin changes
• Recurrent infections
Physical Exam

- **Kaposi-Stemmer sign:**
  - Inability to pinch a fold of skin on the dorsum of the foot at the base of the second toe is a sign of lymphedema
Diagnosis

Lymphoscintigraphy
### Lymphocintigraphy Transport Index

**Kleinhans et al**

<table>
<thead>
<tr>
<th>Score</th>
<th>0</th>
<th>3</th>
<th>5</th>
<th>9</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Transport kinetics</strong></td>
<td>No delay</td>
<td>Mild delay</td>
<td>Extreme delay</td>
<td>No flow</td>
</tr>
<tr>
<td><strong>Distribution pattern</strong></td>
<td>Normal</td>
<td>Partial dermal</td>
<td>Diffuse dermal</td>
<td>No flow</td>
</tr>
<tr>
<td><strong>Time index</strong></td>
<td>Time in minutes for appearance of regional lymph nodes, multiplied by 0.04</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Lymph nodes</strong></td>
<td>Normal</td>
<td>Visible, diminished</td>
<td>Barely visible</td>
<td>Not seen</td>
</tr>
<tr>
<td><strong>Lymph vessels</strong></td>
<td>Normal</td>
<td>Visible, diminished</td>
<td>Barely visible</td>
<td>Not seen</td>
</tr>
</tbody>
</table>

- **Average Score**
  - Asymptomatic - 2.6
  - Lymphedema - 23

- **Transport Index of >5 is Highly Suggestive of Lymphedema**
  - Sensitivity 80%
  - Specificity 94%
Definition & Progression of Lymphedema

• Lymphedema is caused by a failure of the lymphatic system to adequately accept and transfer fluid into the central circulation.
  • May be due to idiopathic (primary) or acquired (secondary) lymphatic disease.

• Lymphedema occurs when excessive fluid and protein accumulate in the interstitial spaces.

• Lymphedema is a chronic (lifelong) disease.

Stage 0
Latency

Stage 1
Pre-Clinical

Stage 2
Clinical

Stage 3
Lymphostatic Elephantiasis
Therapies To Manage Lymphedema

- Complete Decongestive Therapy (CDT)
- Surgery
- Laser therapy
- Diuretics DON’T work
Complete Decongestive Therapy

**Phase I (Intensive)**
- Manual Lymph Drainage
- Compression bandaging
- Exercise
- Skin & nail care
- Instruction in self care

**Phase II (Self Care)**
- Daytime compression garment
- Bandage at night
- Exercise
- Self Manual Lymph Drainage
- Skin & nail care

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**In clinic**

**At home**
Manual Lymphatic Drainage

- Superficial skin stretching techniques; stimulates lymphatics
- Decongests core (trunk & chest) first, clearing proximal areas prior to distal areas
- Reroutes fluid from damaged lymphatic areas to healthy/working lymphatic areas
- Promotes relaxation
- Analgesic effect
- Increases lymph vessel activity
- Increases re-absorption of protein-rich fluid
- Opening of collateral lymphatic pathways
- Stimulated pumping by deep lymphatic drainage pathways
- Breaking down of excess fibrotic tissue
Goals for Therapy

• Decrease girth/volume/pitting
• Improve mobility
  • Increase active ROM and endurance
• Independence with all ADLs
• Improve skin health
• Independent management tasks
  • Bandaging, MLD, skin care, infection monitoring, compression stocking compliance
Who to Refer for Therapy

• Patients with:
  • Edema
  • Family history of lymphedema
  • Difficulty donning compression stockings
  • Ill fitting compression stockings-feel like they are “cutting off circulation” or make swelling worse
  • Recurrent infections associated with edema
  • Failed initial treatments
Newer Compression Devices
Intermittent Pneumatic Compression for Treatment

• Clinical Evidence
  • Multiple studies indicate that, when combined with sustained compression, IPC improves and accelerates healing
  • One study showed patients with the most severe and long standing wounds showed the most improvement
  • Newer study using NIRFLI (near infrared fluorescence lymphatic imaging) demonstrated emptying of distal lymphatic channels and proximal clearing

Rasmussen et al, JVS, 2015
Lymphedema: Before & After
Leg Edema: Causes

- The most likely cause of leg edema in women under age 50 is idiopathic edema (formerly known as cyclic edema).
Idiopathic Edema

- Most common cause of leg edema in females less than 45 years of age
- Usually painless
- Diurnal variation
- Weight gain > 0.7 Kg
- No additional tests
- Conservative management
- Spironolactone
- Avoid loop diuretics
Reflex Sympathetic Dystrophy
Lipedema Characteristics

- Mainly in women
- Bilateral, symmetrical swelling from iliac crest to ankles
- Dorsum of feet never involved
- Stemmer’s sign negative
- Little or no pitting (soft tissue texture)
- No cellulitis
- Painful to palpation, bruise easily, hypersensitive skin
Conclusions

The message is that there are known knowns. There are things we know that we know.

There are known unknowns. That is to say there are things that we now know we don't know.

But there are also unknown unknowns. There are things we don't know we don't know.

Donald Rumsfeld
THANK YOU !