THANK YOU
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NO conflict of interest
Objectives

- Review basic physiology of edema
- Describe various mechanical compression modalities
- Discuss causes of both unilateral and bilateral leg swelling
Edema

**Palpable** swelling produced by expansion of the interstitial fluid volume.
Edema

- Increased capillary hydraulic pressure
- Decreased plasma oncotic pressure
- Increased capillary permeability or interstitial oncotic pressure
- Lymphatic dysfunction
Increased capillary hydraulic pressure

- **Most common cause of edema**
- CHF
- Venous hypertension/obstruction
  - Local vs. Systemic (e.g. DVT vs. pulmonary edema, hepatic cirrhosis)
- Increased plasma volume
  - Renal disease
  - Pregnancy/premenstrual edema
- Medications
Decreased plasma oncotic pressure

- Protein loss
  - Nephrotic syndrome
- Reduced protein synthesis
  - Liver disease
  - Malnutrition
Increased capillary permeability

- Burns/trauma
- Allergic reactions
- Inflammation
- Infection
- Medications
Lymphatic dysfunction

- Lymphedema
  - Primary vs. Secondary

- Lymph node enlargement/dissection

- Hypothyroidism

- Malignant ascites
Medications associated with peripheral edema

“BIG FOUR”

- Calcium channel blockers
  - Diltiazem, amlodipine
- Thiazolidinediones
  - Avandia, actos
- Gabapentin/pregabalin
  - Neurontin, lyrica
<table>
<thead>
<tr>
<th>Medications associated with peripheral edema</th>
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<tbody>
<tr>
<td>• Risperidone</td>
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<tr>
<td>• Pramipexole/ropinirole</td>
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<td>• Insulin</td>
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<tr>
<td>• Hydralazine</td>
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<tr>
<td>• Minoxidil</td>
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<td>• Docetaxel</td>
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<td>• Gemcitabine</td>
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<td>• Sirolimus</td>
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<td>• Valproic acid</td>
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<tr>
<td>• Mirtazapine</td>
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<tr>
<td>• Clonidine</td>
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<tr>
<td>• Beta blockers</td>
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<tr>
<td>• Reserpine</td>
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<tr>
<td>• Methyldopa</td>
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<tr>
<td>• Ticarcillin/carbenicillin</td>
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<td>• Corticosteroids</td>
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<td>• Estrogen/progesterone/testosterone</td>
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Courtesy Steven Dean, DO
Ohio State University Medical Center
History

- Onset (acute vs. chronic)
- Associated injury/illness
- Unilateral vs. bilateral
- Painful?
- Relationship to activity/time of day
- Known systemic diseases/malignancy
- Change in medications
- Recent surgeries or procedures
“Which leg is it?”
Physical Examination

- Unilateral vs. bilateral
- Distribution
- Pitting vs nonpitting
- Skin condition
  - Texture, color, hydration, ulcers
- Temperature
- Pulse examination
- Lymphadenopathy/masses
Lab Evaluation

- CMP
- U/A
- TSH, T4
- CBC/differential
- Albumin
- PSA
- aPTT, PT, D-dimer

- Imaging
  - Venous duplex US
  - Venography/MRV
  - CT scan/MRI
  - Echocardiogram
  - Lymphoscintigraphy
Unilateral Leg Swelling

“BIG FOUR”

- Acute DVT
- Cellulitis
- Chronic venous insufficiency
- Lymphedema
Unilateral Leg Swelling

- Popliteal aneurysm
- Dependency
- Hemihypertrophy
- Hemangioma
- Complex Regional Pain Syndrome
- Arterial-venous malformation
- Hematoma
- Tumor
- Baker’s cyst
- Reperfusion edema
- Abcess/osteomyelitis
- Charcot arthropathy
- Trauma/compartment syndrome
- Gastrocnemius rupture
- Factitial

Bilateral Leg Swelling

- CVI
- Medications
- Idiopathic edema
- Heart failure
- Pulmonary HTN
- Obesity
- Premenstrual edema
- Pregnancy
- Lymphedema
- CKD
- Cirrhosis
- Dependency/disuse
- Lipedema
- Preeclampsia
- Pretibial myxedema
- Cardiomyopathy

Acute Deep Venous Thrombosis

RISK FACTORS

• Age
• Immobilization
• Pregnancy/postpartum
• Major surgery
• Long plane rides/car trips
• Cancer
• Previous history of DVT
• Stroke
• Major trauma
Cellulitis

Diffuse, blotchy erythema and calor

Macerated webspaces
Stasis Cellulitis

- 55 year old lady with chronic leg swelling and redness
- Multiple courses of antibiotics from PCP for cellulitis
Chronic Venous Insufficiency

• Most common cause of *chronic* leg swelling and ulcers in older patients

• Unilateral or bilateral
Chronic Venous Insufficiency

- Stasis ulceration
- Atrophie blanche
- Post-thrombotic syndrome
CVI and right side stroke

- 79 year old woman with chronic b/l leg edema, L>R
- Legs of equal temperature
- Normal pedal pulses
Elephantiasis

“Buffalo hump”
Lymphedema

Pathophysiology

- Lymphatic absence/obstruction/functional impairment
- Accumulation of protein-rich interstitial fluid
- Chronic inflammation
- Cellular proliferation
  - Fibrosis
  - Hyperkeratosis, papillomatosis
  - Melanosis/pigmentation
Lymphedema

Primary

- Congenital
  - < 2 years

- Praecox
  - 2-35 years

- Tarda
  - > 35 years

Secondary

- Infectious
  - Cellulitis/lymphangitis

- Malignancy
  - Men – Prostate
  - Women – Breast

- Iatrogenic
  - Vein harvest

- Traumatic
  - Injury/self-mutilation

- Other

CVI

Lipedema
UNILATERAL SINCE BIRTH
Lymphedema

- 52 year old morbidly obese man with remote h/o MVA and left leg trauma
Lymphedema with chronic venous insufficiency
Lymphedema with chronic venous insufficiency

Stemmer’s sign

Pitting edema
Compression Therapy

- Cornerstone of management of chronic venous disease and lymphedema

Modalities
- Compression stockings
- Bandages/wraps
- Adjunctive devices
- Pneumatic pumps
Single Layer Bandages/Wraps
Multi-Layer Compression Systems
Severe Congenital Lymphedema Managed with Pneumatic Pump

Case courtesy Douglas Joseph DO, Cleveland Clinic
Lipedema

• Grossly enlarged buttocks and legs
• Bilateral and symmetrical
• Spares the foot - "ankle cut off sign"
• Torso relatively normal and disproportionate to the legs
• Often misdiagnosed as lymphedema
16 year female with painful swollen toes

No trauma or injury

No past medical history or medications
Pernio (Chilblains Disease)

- Localized inflammatory skin lesions as a result of defective cutaneous circulation
- Intense and prolonged vasospasm during cold exposure
- Lesions begin in winter or fall and resolve with warm weather

Treatment

- Cold avoidance
- Calcium channel blockers/vasodilators
- Nicotinic acid
- Sympathectomy
Venous malformation

- 26 year old man with chronic right foot swelling x 10 years
- Poor compliance with compression therapy
- Active smoker
- Radiographs with evidence of septic arthritis/osteomyelitis
• 31 year old obese diabetic man with left foot, ankle, and lower leg pain and swelling for approximately 1 year

• Treated for lymphedema with mechanical pumping and compression stockings

Charcot arthropathy

February, 2004
- 70 year old diabetic man with h/o renal transplant
- Multiple revascularizations
- Ischemic necrosis and amputations of multiple fingers

**PAD with critical limb ischemia**

**DO NOT COMPRESS!**
Ischemia rest pain improved with dependency

- Dependent rubor
- Elevation pallor
Phlegmasia Cerulea Dolens

- Venous thrombosis of the deep and superficial venous systems
- Painful, massive swelling and discoloration
- Diminished or absent pulses
- 50% have an underlying malignancy
- Limb and life threatening emergency!
Conclusions

- Elicit thorough history
- Remember to review medications
  - Calcium channel blockers, Thiazolidinediones, Gabapentin/pregabalin, NSAIDS
- Bilateral leg swelling

In the absence of causative medications or systemic disease:
  - Idiopathic edema (premenopausal females)
  - CVI (older patients)
Conclusions

- Unilateral leg swelling
  - Acute DVT
  - Cellulitis
  - CVI
  - Lymphedema
- Compression therapy may not be indicated
  - Severe PAD, Lipedema, Acute Charcot foot
- Customize compression therapy
  - Accommodate concomitant arterial disease
Conclusions

- Unilateral leg swelling
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Questions?
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