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How to Navigate EDUCATA

The Comprehensive Management of Edema
Part II: Differential Diagnosis and Evaluation of Peripheral Edema

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This course was developed in collaboration with:
Course Description & Goal

This lecture briefly reviews the physiology of edema formation and includes a comprehensive evaluation for an individual with peripheral edema. A systems review and differential diagnosis process is discussed and patient cases are presented to assist the participant in developing a differential diagnosis list. Rehabilitation therapy objective assessment techniques and potential medical diagnostic tests are presented to assist the therapist in determining if physical or occupational therapy is appropriate for an individual with peripheral edema, or if referral to another health care professional is needed.

AOTA: This program is offered for 0.25 CEUs, Advanced Level:

- Domain of OT: Client Factors.

NBCOT 3.125 PDU (Course includes assessment component.)

Disclosure

- The professor of this course has NOT endorsed or received any compensation from the manufacturers or distributors of any of the materials discussed in this presentation.
- Financial: Dr. Perdomo is an Assistant Professor of Clinical Physical Therapy at the University of Southern California in Los Angeles, CA. She developed the outpatient oncology rehabilitation at USC’s faculty practice, and founded the Oncology Rehabilitation and Lymphedema Program at Olympic PT in Seattle, WA, as well as the Oncology Clinical Rotation at the University of Puget Sound in Tacoma, WA. Dr. Perdomo receives compensation from EDUCATA as the professor of this course.
- Nonfinancial: Dr. Perdomo is an active member of the Oncology Section of the APTA and has worked to get oncology specialization recognized by the ABPTS. She has also been a district representative for the California chapter of the APTA.

Course Objectives

Upon completion of this course, the participant shall be able to:

- Identify the systemic and local causes of peripheral edema.
- Utilize and apply Starling’s law of equilibrium to guide their thought process when evaluating an individual with peripheral edema.
- Determine if physical therapy is appropriate for an individual with peripheral edema, or if referral to another health care provider is necessary.
- Perform an appropriate physical therapy evaluation for an individual with peripheral edema.
- Identify red flags during an evaluation of an individual with peripheral edema.
Chronic Edema

- Medically, it is a sign of “ill health.”
- Excessive accumulation of interstitial fluid.
- May occur in the lungs, abdominal cavity, peripheral tissues, almost any body part.
- Categorized as systemic or local.
- Healthcare providers often fail to consider the dynamic physiological forces responsible for tissue fluid balance.

Consequences of Edema

- Increased interstitial diffusion distance for O₂ and nutrients.
- Chronic edema impairs cell nutrition.
- Tissue viability can be impaired.
- Impairs mobility and function, causes pain, infection and wounds.

Clinical Edema

- Requires the PT to investigate the cause.
- Knowledge base of the pathophysiology of edema formation.
  - Starling’s law
  - Differential diagnosis thought process considers both systemic and local causes of peripheral edema.
How Does Edema Form?

- Edema forms due to either an increase in capillary filtration, a reduction in lymph drainage or a combination of the two. (Cho et al 2002; Kerchner et al 2008)
- Edema is the result of movement of fluid into the vascular, interstitial, or lymphatic compartments, without equivalent removal of this fluid.

Key Concepts

- Filtration and reabsorption are governed by Starling’s equation for fluid movement across a semi-permeable membrane.
- All edema is due to a change in one of the components of Starling’s law:
  - Hydrostatic pressure
  - Osmotic pressure
  - Capillary permeability
- Edema results from an imbalance between capillary filtration and lymphatic reabsorption and drainage of interstitial fluid.

Microcirculation

Capillary bed:
- Exchange of nutrients
- The veins and the lymphatic capillary reabsorb fluid from interstitial spaces, thus preventing edema formation.
Starling’s Law of the Capillaries

The rate and direction of fluid exchange between the capillaries and the interstitial space are determined by the net hydrostatic and osmotic pressures of the two compartments.

Starling’s Equation

\[ J_v = L_p S \left( (P_c) - P_i - B (\Pi_p - \Pi_i) \right) \]

- \( J_v \) = capillary filtration rate
- \( L_p \) = hydraulic conductance of capillary wall
- \( S \) = surface area
- \( P \) = pressure within capillary or interstitium
- \( B \) = osmotic reflection coefficient of capillary wall
- \( \Pi \) = osmotic pressure of plasma or interstitial fluid

Normal Pressure Gradients

Image
Capillary Bed

Image

Articulate Quizmaker Quiz
Placeholder - Interactive Question #1

PT Differential Diagnosis Process

• Pathophysiology of edema formation.
• System of categorizing or grouping the causes of peripheral edema:
  — Systemic vs. local vs. regional.
  — Grouped by organ systems.
• Perform evaluation based on categories:
  — Screening exams.
  — Clinical signs and symptoms.
  — PMHx, medications, etc.
PT Differential Diagnosis Process

• Consult with MD for diagnostic tests.
• Role of PT is to determine if physical therapy is appropriate:
  – No further consult is needed.
  – Consult needed.
  – Medical attention required.
    • Immediate.
    • Referral to MD.

What Are the Possible Causes of Peripheral Edema?

• Take a minute to write down all the possible causes of peripheral edema you can think of.

• Next, think about the presenting signs & symptoms for each (or a few) of these pathologies and write them down.

• What clinical s & s would you regard as a “red flag?”

Differential Diagnosis of Peripheral Edema

common pathologies

• Chronic venous insufficiency, venous obstructions
• Heart failure
• Organ pathologies:
  – Cardiac, liver (cirrhosis, nephrotic syndrome), kidney dysfunction.
• Myxedema
• Lipedema
• Malignant lymphedema
  – Peripheral edema caused by tumor obstruction.
Possible Causes of Peripheral Edema

- **Organ**
  - Cardiac, kidney (nephrotic syndrome), liver (cirrhosis), thyroid, pulmonary hypertension
- **Regional venous hypertension (unilateral)**
  - DVT, inferior vena cava/iliac compression, compartment syndrome
- **Systemic venous hypertension**
  - Heart failure, constrictive pericarditis, restrictive cardiomyopathy, cirrhosis/liver failure
- **Cancer, obstruction of LN, lymphedema**
- **Increased plasma volume**
  - Heart failure, renal failure, drugs, pregnancy, premenstrual edema

Possible Causes of Peripheral Edema

- **Decreased plasma oncotic pressure**
- **Protein loss**
  - Malabsorption, pre-eclampsia, nephrotic syndrome
- **Reduced protein synthesis**
  - Cirrhosis/liver failure
  - Malnutrition, malabsorption, beriberi
- **Increased capillary permeability**
  - Allergic reactions: hives, serum sickness, angioedema
  - Inflammation/local infection, burns
  - Interleukin 2 therapy
- **Medications, trauma, CRPS II, stroke, lipedema, myxedema**

How or Why Does Peripheral Edema Develop?

Using the physiological principles presented in part I of this series, can you discuss edema on the basis of the following?

- Increased capillary permeability
- Increased venous hypertension
- Decreased osmotic pressure gradient
<table>
<thead>
<tr>
<th>Edema</th>
<th>↑ Venous Pressure</th>
<th>↓ COP</th>
<th>↑ Capillary Permeability</th>
</tr>
</thead>
<tbody>
<tr>
<td>• R ventricular failure</td>
<td>• Malnutrition</td>
<td>• Breakdown endothelial barrier</td>
<td></td>
</tr>
<tr>
<td>• Salt + water overload</td>
<td>• Malabsorption</td>
<td>• Vasodilatation ↑ capillary pressure</td>
<td></td>
</tr>
<tr>
<td>• Venous obstruction</td>
<td>• Protein loss disease</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Venous reflux</td>
<td>— Cirrhosis</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Dependent position</td>
<td>— Renal failure</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• DVT</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Venous obstruction</td>
<td>• Nephrotic syndrome</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Venous reflux</td>
<td>— Proteinuria</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Dependent position</td>
<td>— Hypercholesteremia</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• DVT</td>
<td>— Hypoalbuminemia</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• External compression</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Pelvic tumor</td>
<td>• Hepatic failure</td>
<td></td>
<td></td>
</tr>
<tr>
<td>— Ovarian</td>
<td>— Inability to synthesize albumin</td>
<td></td>
<td></td>
</tr>
<tr>
<td>— Uterine</td>
<td>— due to liver disease</td>
<td></td>
<td></td>
</tr>
<tr>
<td>— Prostate</td>
<td>— Chronic inflammation</td>
<td></td>
<td></td>
</tr>
<tr>
<td>— Retroperitoneal</td>
<td>— Allergic reactions</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Medications</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Venous Diseases

<table>
<thead>
<tr>
<th>DVT</th>
<th>Varicose Veins</th>
<th>CVI</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Asymptomatic</td>
<td>• Asymptomatic</td>
<td>• Symptoms ↑ standing</td>
</tr>
<tr>
<td>• Dull ache</td>
<td>• Gradual dull aching, heaviness, tension, fatigue</td>
<td>• Progressive edema, thickening, brownish pigmentation of the skin, venous stasis ulcers</td>
</tr>
<tr>
<td>• Tight feeling</td>
<td>• Symptoms ↑ standing</td>
<td>• Moderate to severe edema</td>
</tr>
<tr>
<td>• Tenderness/pain in the calf</td>
<td>• Cramping, esp @ night</td>
<td>• Dense woody texture</td>
</tr>
<tr>
<td>• Leg or calf swelling</td>
<td>• Elevation provides relief</td>
<td>• Skin is thin, dry, shiny</td>
</tr>
<tr>
<td>• Dilatation of superficial veins</td>
<td>• Itching</td>
<td>• Dermatitis/cellulitis</td>
</tr>
<tr>
<td>• Pitting edema</td>
<td>• Dilated, tortuous elongated veins</td>
<td>• May lead to lymphedema</td>
</tr>
<tr>
<td>• Warmth</td>
<td>• Skin changes; hemosiderin stains (brown)</td>
<td></td>
</tr>
<tr>
<td>• Usually unilateral</td>
<td>• Thinning of the skin</td>
<td></td>
</tr>
<tr>
<td>• History of trauma</td>
<td>• Can result in blood clots, phlebitis or ulcers</td>
<td></td>
</tr>
<tr>
<td>• Risk factors</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Clinical Decision Rule for DVT

- From Wells and colleagues:
  - Active cancer (during its or within 6 months, or palliation) (1)
  - Paralysis, paresis, or recent immobilization of lower extremity (1)
  - Bedridden > 3 days; major surgery within 12 weeks (1)
  - Localized tenderness along distribution of deep veins (1)
  - Entire leg swollen (1)
  - Calf swelling of 3 cm > asymptomatic leg (10 cm below tibial tuberosity) (2)
  - Pitting edema involved in LE only (1)
  - Collateral superficial veins (1)
  - Alternative diagnosis as likely as DVT (-2)

- Scoring (probability)
  - High: 3 points or more
  - Moderate: 1 or 2 points
  - Low: 0 or less

Primary Care Rule to Rule Out DVT

- Male sex (1 pt)
- Oral contraceptive use (1 pt)
- Presence of active malignancy (1 pt)
- Major surgery in last 3 months (1 pt)
- Absence of leg trauma (1 pt)
- Localized tenderness of deep venous system (1 pt)
- Calf swelling > 3 cm (2 pts)
- Positive D-dimer result (6 pts)
Continuum of Venous Disease

Examples of Venous Diseases

Venous Disease Developing Into Secondary Lymphedema
Clinical Presentation
Pathologies of the lymphatic system leading to peripheral edema

**Lymphedema vs. Lipedema**

<table>
<thead>
<tr>
<th>Lymphedema</th>
<th>Lipedema</th>
</tr>
</thead>
<tbody>
<tr>
<td>Painless → painful swelling</td>
<td>Typical onset during teens</td>
</tr>
<tr>
<td>Heaviness, ache</td>
<td>+ Family Hx</td>
</tr>
<tr>
<td>Initially, elevation decreases swelling</td>
<td>Primarily female</td>
</tr>
<tr>
<td>Palpation: soft and easily pits → brawny and harder to pit</td>
<td>Symmetrical, B LE enlargement of the buttock which gradually progresses with sparring feet</td>
</tr>
<tr>
<td>Subcutaneous changes, Hyperkeratosis, papillomatosis</td>
<td>Cool, soft and painful with palpation</td>
</tr>
<tr>
<td>+ Stemmer sign</td>
<td>Easily bruises</td>
</tr>
<tr>
<td>History of lymph node/vessel trauma</td>
<td>Does not reduce with elevation</td>
</tr>
<tr>
<td>Age of onset</td>
<td>Most with normal appearance of the waist and upper trunk</td>
</tr>
<tr>
<td>Recurrent infections</td>
<td>Weight loss</td>
</tr>
<tr>
<td></td>
<td>History of being &quot;fat&quot; and diets don't work</td>
</tr>
</tbody>
</table>


Rackon 2008; Tsuart 2003.
Lipedema

Pathophysiology

- Several theories regarding etiology.
- Exact cause is unknown.
- Chronic disease of abnormal lipid metabolism.
  - Symmetrical deposition and storage of adipose tissue.
  - Hyperplasia of fat cells.
  - Primarily in women.
  - Hormonal disorder.
  - Microangiopathy results in increased capillary fragility.

Myxedema

Etiology

- Physiological reaction to insufficient thyroid hormone.
- Caused by a decrease in function of the thyroid gland; glandular atrophy; or by removal of the thyroid.
- High serum concentrations of thyroid-stimulating hormone receptor antibodies.
- Most commonly occurs 1–2 years after diagnosis of Graves’ disease.
- Other endocrine glands may also be affected by the lack of thyroid hormone.

Myxedema

Clinical Presentation

- Localized skin lesions commonly present on the pretibial area of the legs (dermopathy).
- Non-pitting edema at the pretibial areas of the legs, i.e., anterior and lateral aspects.
- Ophthalmyopathy
- Elephantitis may develop.
- Medical treatment:
  - Thyroid replacement
  - Corticosteroids
  - Compression therapy
Differential Diagnosis of Chronic Leg Edema in Primary Care

- Elevated pulmonary artery pressure
- CHF
- Venous insufficiency
- NSAIDs, calcium-channel blockers
- Proteinuria

- Recommendation:
  - Cardiovascular testing in individuals with leg edema > 45 years:
    - Echocardiogram.
    - Rule out pulmonary hypertension.
  - Ely et al 2006:
    - Assume individuals have venous insufficiency, CHF or cyclic edema unless another cause is indicated by hx and PE.
    - Pulmonary HTN and early CHF can cause leg edema before clinically evident.

Laboratory Tests

- Comprehensive metabolic panel
- Complete blood count (CBC)
- Thyroid-stimulating hormone
- Urinalysis
  - Used to determine basic renal, liver, thyroid function and nutritional status.
- ECG and chest X-ray for cardiopulmonary etiology.
- B-type natriuretic peptide blood concentration for heart failure.

Lab Values

- Blood urea nitrogen (BUN)
  - 6 – 20 mg/dL = normal
  - If ↑: CHF, MI, cancer, urinary tract obstruction
- Creatinine
  - 0.9 – 1.3 mg/dL = normal
  - If ↑: Renal dysfunction, hyperthyroid, CHF, dehydration, urinary tract obstruction
**Lab Values**

**cardiac**

- Brain natriuretic peptide (BNP)
  - Hormone secreted by the heart due to pressure or fluid overload present.
  - Sensitive to HF
  - 4 – < 100 pg/ml = normal
- Creatinine phosphokinase test (CPK): CK – MB
  - 0 – 120 ng/mL = normal
  - If abnormal: MI, CHF

**Lab Values**

**liver**

- Bilirubin
  - 0.3 – 1.0 mg/dL = normal
  - If ↑: Anemia, CHF, liver disease, hepatic obstruction
- Albumin
  - 3.5 – 4.8 grams/dL = normal
  - If ↓: Liver, thyroid, Crohn’s disease, malnutrition, peripheral edema, hypotension

**Lab Values**

- Consideration of cardiac, liver and kidney health.
- If lab values are available, then these values play a role for the PT when deciding what treatment options are indicated.
- Consultation with the medical team is required.
### Summary

**Pathophysiology**
- Edema related to:
  - ↑ capillary permeability?
  - ↓ osmotic pressure?
  - ↑ venous pressure?
  - ↓ lymphatic reabsorption and transportation?
  - Combination?

**System-related**
- Cardiac
- Pulmonary
- Kidney
- Liver
- Venous
- Cancer

### The Differential Diagnosis Process

Case presentation: “Mark”
Case Presentation

Mark is a 71-year-old male, referred to PT with a Dx of “Parkinsonism,” for evaluation of falls risk.

- **C/C:**
  - Balance problems
  - ↓ confidence with amb
  - 4 falls in 2 years
  - ↓ walking distance/4 mos

- **Prior level of function:**
  - 4 months ago, was walking 2½ mi/day.
  - Presently amb 8 – 12 blocks, 3 – 4x weekly.

- **PMHx**
  - Cataract surgery 10 yrs ago
  - HTN
  - Hepatitis 22 yrs ago, due to occupational exposure
  - L spine arthritis
  - Vitamin B12 deficiency
  - Anemia
  - Possible mild kidney dysfunction

Mark is a 71-year-old male, referred to PT with a Dx of “Parkinsonism,” for evaluation of falls risk.

- Initially presented with swelling in the feet and ankles, greater on the right than the left.

- Swelling now includes both knees and possibly both thighs.

- **Pause the presentation.**
  - What are all of the possible causes for this patient’s presentation of peripheral edema?
  - Write down:
    - A list of possible causes.
    - Questions you’d have to ask the patient based on these causes.
  - Then continue with the presentation.

### Hypothesis List

<table>
<thead>
<tr>
<th>Systemic causes</th>
<th>Questions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cancer</td>
<td>Any medication changes or new meds?</td>
</tr>
<tr>
<td>— Prostate</td>
<td>Last check-up?</td>
</tr>
<tr>
<td>— Colorectal</td>
<td>What was tested?</td>
</tr>
<tr>
<td>— Bladder, pancreas, kidney</td>
<td>Complete metabolic panel?</td>
</tr>
<tr>
<td>Kidney</td>
<td>— PSA test</td>
</tr>
<tr>
<td>Cardiac</td>
<td>— Thyroid-stimulating hormone</td>
</tr>
<tr>
<td>Thyroid</td>
<td>— CBC</td>
</tr>
<tr>
<td>Medications</td>
<td>Stool sample?</td>
</tr>
<tr>
<td>HTN</td>
<td>Fatigue?</td>
</tr>
</tbody>
</table>
Case Presentation

medications

- Vitamin B12, injections
- Vitamin B6, oral
- Folic acid
- Allopurinol
- Altace
- Imdur (Isosorbide)
- Lasix (Furosemide)
- Lipitor
- Prilosec
- Mirapex (Pramipexole)
- Nicotinamide (Niacinamide)
- TYLENOL (Acetaminophen)

- How long has the patient been taking each medication? Has the dose changed at all?
- Do you (the PT) know:
  - What these drugs are used for?
  - Any of their adverse effects?
  - Can you quickly research these drugs on Google or drugs.com?

Questions for Mark’s Doctor

- Can he run:
  - A PSA test?
  - Some blood tests?
  - Urinalysis?
- Other things to discuss with his doctor:
  - Hypertension
  - Chronic venous insufficiency – is there a possibility of blood clots?
2nd Consult: Evaluation Results

- ECG: normal
- Doppler LE: negative
- CT and MRI of pelvis and LE: negative
- PSA: WNL
- Urinalysis: negative
- Kidney function tests: normal/no change

2nd Consult: Evaluation Results

- Significant B LE edema now involving both thighs.
- 2-year history of ankle edema.
- Soft and easily pits.
- Hemosiderin stains on R LE.
- Decreased skin mobility throughout B anterior tibias and at malleoli.

What Else Could Be Causing Edema?

- Has he travelled outside the country recently? Any chance of infection, parasite, etc.?
- Spider bite on R foot sent him to the ICU over a year ago.
- Was released with a clean bill of health.
- If this is the cause, why is the edema bilateral?
What Else Could Be Causing Edema?

• Has he travelled outside the country recently? Any chance of infection, parasite, etc.?
• Spider bite on R foot sent him to the ICU over a year ago.
• Was released with a clean bill of health.
• If this is the cause, why is the edema bilateral?
• But wait! Mirapex can cause edema in a small number of patients.
• Dr. took him off Mirapex; continued PT. Swelling was completely gone in L leg and 75% gone in R.
• Sometimes it is an extensive process to get to the correct cause.

Clinical Investigation

Evaluation of peripheral edema

Subjective Interview

| Onset     | • When? Gradual or sudden? |
| Location  | • Everywhere or localized? |
| Duration  | • Unilateral or bilateral? UE/LE? |
| Characteristics | • Indentations? Pain? Wounds? Discoloration? |
| Associated symptoms | • Breaks in skin? |
| Aggravating factors | • Weight loss or gain? SOB? Awaken at night with difficulty breathing? |
| Easing factors | • Trauma? Sitting/standing? |
| Severity  | • Change in diet? Salt intake? |
|           | • New meds/change in dose? |
|           | • Better in AM? Elevation? Other? |
|           | • Rings, shoes, clothes tighter? |
|           | • Difficulty walking? |
Key Elements of History

- Unilateral or bilateral?
- Duration of edema?
- Is the edema painful?
- Medications
- PMHx of systemic disease
- History of radiation therapy, LN surgery, Ca
- Improves with elevation or overnight?
- History of sleep apnea
- Patient demographics (age, gender, obesity)
- Lifestyle habits (smoker, alcohol use)

Unilateral or Bilateral?

LE edema
- DVT, CVI
- Lymphedema
- Compartment syndrome
- Obstruction of inguinal LN
- Trauma/immobilization
- CRPS-II

B LE edema
- Heart failure
- Kidney/liver disease
- Lymphedema
- Lipedema
- Medications
- CVI
- Obstruction of pelvic/abdominal LN
- Combination of causes

Medications

- Antihypertensive drugs
  - Ca channel blockers, beta blockers, Clonidine
  - Hydralazine, Minoxidil, Methyl dopa
- Hormones
  - Corticosteroids, estrogen, progesterone & testosterone
- Chemotherapy-related drugs
- Other
  - Nonsteroidal anti-inflammatory agents, Pioglitazone, Rosiglitazone, monoamine oxidase inhibitors
  - A vast majority of drugs list peripheral edema as a side effect.
General Red Flags

- Progressive edema.
- Sudden onset without traumatic event.
- Edema with fever, sweats and chills.
- Edema with shortness of breath.
- Calf pain and swelling associated with trauma.
- Edema of the face or arm with discoloration of the chest, arm, face, loss of carotid pulses, HA, dizziness, chest pain, wheezing or dysphasia.

Now that all other diagnoses have been eliminated...
Let us continue with the evaluation.

Physical therapy is appropriate for our patient.

ICF Conceptual Framework

Health condition (Pathology: lymphedema)

Activity (Functional limitations)
- Gait
- Transfers
- Lifting ability
- Driving
- Sitting
- Vacuuming
- Work/school tasks
- Chewing

Participation (Disability)
- Parent
- Caregiver
- Employee
- Volunteer
- Vacationer
- Parishioner
- Athlete

Body functions and structures (Impairments)
- ROM
- Strength
- Edema
- Endurance
- Sensation
- Pain

Environmental Factors

Personal Factors
Evaluation

- Hx of c/c
- PMHx
- Screening exams
  - Musculoskeletal
  - Neuromuscular
  - Cardiopulmonary
  - Integumentary
- Patient’s goals
- Assessment
- Prognosis
- Treatment plan of care

Cardiopulmonary

- Vitals
  - BP, RR, pulses, weight, height
  - Edema may not be visible until 10% weight gain.
- Auscultation of lung and heart sounds
  - Crackles or abnormal heart sounds.
- Jugular vein distension
- Displaced point of maximal impulse
- 6 min walk test
- 4 min treadmill test

Lung Auscultation
**Jugular Vein Distention**

**Point of Maximum Impulse (PMI)**

**Integumentary Evaluation**

- Observation
- Palpation
- Skin mobility & texture
- Pitting/non-pitting
- Measurement
  - Circumferential measurements
  - Volumetric water displacement
  - Pedometer
## Assessment of Pitting

### Wiese method
- Apply pressure for 5 seconds.
- Record time taken for the skin to return to normal.

### Interpretation
- +1: 30 secs to return to normal
- +2: 30 – 60 seconds
- +3: 60 – 90 seconds
- +4: 90 – 120 seconds

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## Assessment of Pitting

### Doughty & Holbrook
- Measures depth of pitting.
- Interpretation:
  - 2 mm depth = 1+
  - 4 mm depth = 2+
  - 6 mm depth = 3+
  - 8 mm depth = 4+

### Non-pitting edema
- Indicates fibrosis
- Lymphedema
- Lipedema
- Myxedema
- CVI
- Often referred to as "brawny edema."
- Is not graded.

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## Screening Exams

### Musculoskeletal
- AROM
- PROM
- Functional back scratch test
- MMT: key musculoskeletal testing
- Scapula mobility
- Gleno-humeral: scapula rhythm
- Lumbo-pelvic rhythm
  - Gross functional movement patterns
- Observation of atrophy

### Neuromuscular
- Key muscle testing
- Reflexes
  - Upper
  - Lower
  - Pathological
- Sensory exam
- Fine motor tests
- Hand dynamometer
Summary of Differential Diagnostic Process

- Peripheral edema is determined by Starling’s law of equilibrium:
  - Permeability of the vascular system.
  - Hydrostatic pressure.
  - Osmotic pressure.
- Lymphatic drainage of interstitial fluid.

Lower Leg Edema: Dx Process

- Increase in hydrostatic pressure
- Obstruction from tumor, DVT, inflammation from trauma
- Question the patient about:
  - Trauma (even mild direct trauma to the calf)
  - Use of birth control pills
  - Immobilization
  - Varicosities
  - Pelvic pain
- Signs and symptoms of CHF:
  - Kidney or liver pathology affecting albumin production.
  - Decreased production of albumin
  - Liver function tests. Consider diet in elderly, or alcohol use.
  - Decrease in oncotic pressure
- Loss of albumin
- Evaluate patient with urinalysis to determine whether proteinuria present in kidneys.

Note: Differentiating edema on examination involves:
- Distinguishing between pitting and non-pitting edema.
- Resolution of edema with elevation of legs.
PT Differential Diagnosis

- Consider cardiac, kidney & liver pathology.
- Correlate clinical signs with medical history.
- Determine the onset, nature, behavior of the edema.
- Perform clinical vascular tests:
  - Both venous & arterial.
- Does the history match the clinical presentation?
- Consult with other medical professionals.

CAOPT Certificate of Achievement in Oncology Physical Therapy

- Awarded to those who complete online and on-site training in specialty areas related to oncological rehabilitation.
- The CAOPT- Edema certificate consists of the following components:
  - Foundations of Oncology for Physical Therapists: Medical Aspects
  - The Comprehensive Management of Edema (all 4 lectures)
  - Peripheral Edema Management: Physical Agents
  - A 60-hour regional lab, offered by the Oncology section

For more information, visit the Oncology section’s website.

Thank You