Edema: Comprehensive Management
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Disclosures
• The speaker has no financial conflict of interest for content of this presentation.
• The speaker is not endorsing any particular product or type of equipment.

Course Objectives
• To recognize the anatomy and function of the lymphatic system
• To identify different types of edema
• To describe the best treatment approaches for low protein versus high protein edema
• To understand the basics of general wound care management

Why edema management?
• You can find it in all settings of physical therapy practice
• Complicated edema can limit function, mobility, and overall outcome of care
• It is within our scope of practice as physical therapy practitioners

Role of the Lymphatic System
• Conduct immune system surveillance
  — Immediate and long term response to pathogens
• Assist the cardiovascular system to maintain fluid homeostasis
• Aid the digestive system in the breakdown of long-chain fatty acids

THE LYMPHATIC SYSTEM
Anatomy of the Lymphatic System

• **Lymph fluid**: clear and transparent semifluid medium

• **Lymphatic loads**: protein, water, cellular components and particles, and fat

Components of the Lymphatic System

• Initial lymphatics (capillaries) and pre-collectors – absorb

• Collector lymphatics – conduct

• Lymph nodes – filter and conduct

• Lymph trunks – deeper, conduct

• Thoracic duct – deepest, largest, conducts

Normal Lymph Flow

Lymph capillaries ➔ Pre-collectors ➔ Collectors ➔ Lymph Nodes ➔ Lymphatic Trunks ➔ Thoracic/Right Lymphatic Duct ➔ Left or Right Subclavian Vein ➔ Heart

Lymph Capillaries

• Also known as the initial lymphatics

• “Mesh” like complex throughout the body

• Responsible for lymph formation

• Anchoring filaments facilitate opening and closing of capillary junctions

• Mobilization of soft tissue from the outside can facilitate change in pressure and stimulate anchoring filaments

Pre-Collectors and Collectors

• Pre-collectors
  – Connection between lymph capillaries and collectors

• Collectors
  – Moves fluid to lymph nodes and on to lymphatic trunks
  – Similar structure to veins
  – Contains valves (pair = lymphangion, every 6-20mm)
  – Contracts 10-12 times per minute (smooth muscle)

Lymph Nodes

• Regional and central, 600-700 in the body

• **Protective function**: filters, phagocytosis of pathogens, waste products and dead cells

• **Immune function**: make antibodies

• **Thickening of the lymph fluid**: blood capillaries reabsorb water
• **Lymphotomes**: superficial anatomical segments that divide the body into specific areas/territories drained by the same group of nodes
• **Watersheds**: division areas between two lymphotomes that allow lymph to move against the normal flow

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**Lymphatic Trunks and Ducts**

• **Lymphatic Trunks**
  – Similar to the collectors but have more developed muscle structure
  – A result of when superficial and deep collectors merge
  – Sends fluid to venous angles
• **Thoracic Duct**
  – From L2 to T4
  – Lymph from bilateral LE, left arm, and left quadrant of face
  – Empties into the left venous angle
• **Right lymphatic Duct**
  – Lymph from right arm, upper right quadrant, and face
  – Empties into the right venous angle

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**Return of Lymph Fluid**

• **Venous system**: left and right venous angles between the subclavian and jugular veins at the level of the clavicles
• Only direct connection with lymph and venous systems
• Feeds back into the circulatory system (heart).

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**Physiology: Starling Equilibrium Equation**

\[ J_v = K_f \left[ P_c - P_i f - \sigma (\pi_p - \pi_i) \right] \]

Capillary filtrate = Permeability of water and small solutes [Hydrostatic pressure gradient – Permeability of plasma protein (Colloid osmotic pressure gradient)]

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When the fluid flows from the interstitial space into the capillary, it is termed **reabsorption**

When the fluid flows from the capillary into the interstitial space, it is termed **filtration**
Physiology

• **Functional reserve of the lymphatic system**: The transport capacity of the lymphatic system is 10x greater than (> the physiologic amount of lymph loads (normal function).
• If needed, the lymphatic system can assist when there is an overload of venous fluid present.
• **Dynamic insufficiency** = Lymph load > Transport capacity. Thus, edema is noted.

Abnormal Physiology: Lymphedema

• **Lymphedema/Lymphostatic edema** = mechanical insufficiency or low-volume insufficiency of the lymphatic system
  – High protein content is the *highlight* of lymphedema compared to other edemas.

<table>
<thead>
<tr>
<th>Lymphatic Failure</th>
<th>Transport Capacity</th>
<th>Lymphatic Load</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dynamic (edema)</td>
<td>Normal</td>
<td>Increased</td>
</tr>
<tr>
<td>Mechanical (lymphedema)</td>
<td>Decreased</td>
<td>Normal</td>
</tr>
<tr>
<td>Combination (lymphedema)</td>
<td>Decreased</td>
<td>Increased</td>
</tr>
<tr>
<td>Hemodynamic (cardiac edema)</td>
<td>Normal/Decreased</td>
<td>Increased due to right ventricular failure</td>
</tr>
</tbody>
</table>

What do I ask? What do I look at?

**Evaluation and Assessment Considerations**

Subjective

• Any recent health changes?
• Did the swelling occur fast or slow?
• Does the swelling improve with elevation?
• Does the swelling improve with diuretics?

Subjective

• Have you had any recent infection or blood clot?
• Where do you sleep?
• Is there any pain associated with the swelling?
• Does the swelling limit your function?
Past Medical History

• Full systems review
• Cancer and its treatments
• Infections
• Surgeries or traumas
• Functional status and activity level
• History of smoking and alcohol use
• Social history

Objective

• General PT assessment
• Skin integrity (palpation, texture, color, temperature, pitting, scars)
• Volume or girth measurements of the involved areas of the body
  – If present in the extremities, symmetric or asymmetric
• Pain

Classifying Pitting Edema

• 1+ = 2mm or less, disappears rapidly
• 2+ = 2-4mm, disappears in 10-15 seconds
• 3+ = 4-6mm, may last more than 1 minute
• 4+ = 6-8mm, lasts as long as 2-5 minutes

Objective

• Stemmer sign: the only clinical test that is a reliable and valid method to diagnose lymphedema
  – Thickening of the skin of the proximal phalanges of the toes or finger of the involved limb
  – Can’t “tent” or pick up the skin when pinched
  – Positive = definite indication of lymphedema
  – Negative = absence of the diagnosis is not certain

Differential Diagnosis for Types of Edema

• Lymphedema is a chronic, incurable condition that is characterized by an abnormal collection of fluid owing to an anatomical alteration of the lymphatic system (Macdonald, JM. 2002)
• High protein type edema
• Can classified as a primary or secondary lymphedema
• Staged from Stage 0 to Stage 3
Etiology of Lymphedema: Primary

- Milroy’s disease (congenital lymphedema)
- Meige’s disease (lymphedema praecox)
- Lymphedema Tarda

Etiology of Lymphedema: Secondary

- Damage to lymph nodes and/or lymph vessels that results in mechanical insufficiency
- Possible causes: Trauma, Radiation therapy, Tumor obstruction, Infection, CVI, Surgery, Infection

Stages of Lymphedema

- Stage 0 / Subclinical: Patient feels “heaviness” in involved limb. Fibrotic changes and fluid accumulation can occur before visible swelling or pitting
- Stage 1: Reversible lymphedema. Accumulation of protein-rich fluid, elevation reduces swelling. Tissue pits on pressure.

Stages of Lymphedema

- Stage 2: Spontaneously irreversible lymphedema. Proteins stimulate fibroblast formation (fibrosis). Connective tissue and scar tissue proliferate. Minimal pitting, even with moderate swelling.
- Stage 3: Lymphostatic elephantiasis. Hardening of dermal tissues, papillomas of the skin, tissue appearance is elephant-like (not all progress to this stage).

Venous Hypertension Related Edema

- Chronic “venous insufficiency”
- Post thrombotic syndrome can lead to this
- Increase in blood capillary pressure results in an increase in net filtration causing an increase in lymphatic load
- Hemosiderin staining is the key indicator

Phlebolymphedema

- End stage venous insufficiency related edema can cause significant overload to the lymphatic system causing permanent changes
- This is when one would see lipodermatosclerosis
- Limb size may be small relative to the end stages of lymphedema but demonstrates ulcerations, varicosis, and pain
Lipedema

- “Lipedema is a chronic metabolic disorder of the adipose tissue, of unknown etiology, and is marked by a bilateral and symmetrical swelling of the lower extremities, caused by extensive deposits of subcutaneous fatty tissue.” Allen and Hines, 1940

Lipedema

- Often misdiagnosed as bilateral primary lymphedema, extreme “cellulitis,” or morbid obesity
- Spares the feet, bilateral and symmetrical, negative stemmers sign
- Almost exclusively women
- Can lead to lymphedema (lipolymphedema) and venous disorders
- Does not improve with exercise

Edema Due to Malignancy

- Growth of the tumor can place pressure on and limit the lymphatic system
- Symptoms include pain, paresthesias, paralysis, rapid development of swelling
- Can lead to tissue break down and wounds

Traumatic Edema

- Physical trauma can cause a temporary disruption of the transport capacity
- Significant scarring with trauma can lead to a secondary lymphedema
- Surgery, blunt trauma, and burns can result in inflammatory reactions
- Typically returns back to normal

Fluid Retention States

- Endocrine, cardiac, renal, hepatic, and other medical conditions can result in the body retaining fluids
- Typically full body and bilateral involvement to the limbs is noted
- Soft “marshmallow” like, low protein edema
- Can be treated with diuretics
- If poorly managed, can turn into a lymphedema

Other Inflammatory Processes

- Inflammation causes protein dumping from the capillaries
- Inflammatory rheumatism / rheumatoid arthritis: inflammation of the synovial membrane of joints
- Reflex sympathetic dystrophy: pain, edema, autonomic dysfunction, movement disorder and trophic changes
- Osteoarthritis
Dependent Edema

- Often seen in those that are sedentary or have limited mobility
- Impaired lymphatic flow due to positioning, most commonly the inguinal and popliteal region
- Decreased muscle pump activation
- Typically resolves/improves with elevation and positioning

Cellulitis

- A.K.A. Erysipelas
- Painful inflammation of the soft tissue due to acute infection
- Expanding local erythema, palpable local lymph nodes in some cases, fever and chills
- Most common complication of lymphedema

Lymphangitis

- Inflammation of one or more of the lymphatic vessels, usually due to an infection
- Streptococcal infection most common
- Fine red streaks from infected area that spreads proximally on the limb
- Can present with fever, chills, headache and myalgia
- Treated by penicillin and hot soaks

Now that I have an idea of what type of edema it is, what do I do now?

Treatment Options

Treatment Strategies: Low Protein Edemas

- Low protein edema = all edemas except for lymphedema
- Treat the underlying medical complication
- Elevation/Positional changes
- Muscle pump activation
- Compression management
- Kinesiotaping®
- Electrical Stimulation

Treatment Strategies: High Protein Edemas

- Full decongestive therapy
- Lymphedema/vasopneumatic pumps
- Electrical Stimulation
- Kinesiotaping®
Full Decongestive Therapy

- Manual lymphatic drainage
- Compression wraps
- Therapeutic exercise

Goal of Decreasing Lymphatic Load

- Remove stagnant waste products from tissue
- Increase oxygen tissue to promote wound healing
- Decrease cycle to fibrosis

Manual Lymphatic Drainage

- Position patient with head slightly elevated
- Working phase ("on phase"): stretching the soft tissue/subcutaneous tissue
- Resting phase ("off phase"): elasticity of the skin moves the therapist's hand passively to allow absorption from the interstitium

Key Concepts with MLD

- Light pressure applied
- More firm pressure over areas of fibrosis
- Each “working phase” should last about 1 second and repeat 5-7 times
- Clear proximally first and then flow distal to proximal

Key Concepts with MLD

- Clear and flow between groups of lymph nodes
- Pump points: use of two bundles of nodes to facilitate improved lymphatic mobilization
  - Ex. Medial knee and lateral hip
- HEP for self mobilization techniques

Effects of MLD

- Increase lymph production
- Increase lymphangiomotoricity
- Reverse of lymph flow
  - Deep collectors don't cross between watersheds but superficial collectors do
- Increase in venous return
- Soothing
- Analgesic
Contraindications for MLD

- Acute Cardiac edema
- Renal failure
- Acute infections
- Acute bronchitis
- Acute DVT
- Malignancies
- Bronchial asthma
- Hypertension

Precautions for MLD

- Pregnant women
- Abdominal surgeries
- Hyperthyroidism (limit neck due to increase hormone release)
- Aortic aneurysm
- Inflammatory conditions
- Radiation fibrosis

Example MLD Plan for Lymphedema

- 1st treatment session: MLD to trunk
- 2nd treatment: MLD to trunk, plus bilateral limbs
- 3rd treatment: MLD to trunk, plus bilateral limbs, instruction on HEP
- Following sessions: focus on areas of induration, scar tissue, etc.

Example Routine for Edema Post-Op Total Knee Replacement

1. Tummy rubs x10 and deep breathing x5
2. Inguinal node chops x 10 followed by knee to chest
3. Popliteal node clearing x 10 followed by sweeps from inside and outside knee toward LATERAL hip (always distal to proximal)
4. x10 kicks and x20 ankle pumps
5. Tummy rubs x10 and deep breathing x5

Compression Therapy

- Elastic fibers of the cutaneous tissues are damaged in lymphedema
- **Goal** = maintain the decongestive effect during the MLD session

Effects of Compression Therapy

- Improves venous and lymphatic return
- Reduces net filtration
- Improves effect of the muscle pumps
- Prevents re-accumulation of evacuated fluid post MLD
- Helps break up and soften deposits of connective tissue and scar tissue
- Provides support for the now inelastic fibers
**Bandaging**

- Short stretch is the bandage of choice
- Multiple layers used
- Patients should maintain their activity levels
- **Criteria for stabilized edema:** reduction includes remodeling of the subcutaneous fibrosis, pliable tissue with no induration, and no further decrease in girth for 7–10 days.

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**Bandage Application**

- Dress wound(s) as appropriate
- Stockinette first to collect sweat
- Cotton or foam padding
- Typically 3 rolls of short stretch bandage used: smallest to largest width. Spiral application, *never* circumferential

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**Compression Garments**

- Long term compression management
- Used to preserve treatment success during decongestive therapies
- Compression garments meant to **MAINTAIN** current edema not reduce it to baseline
- Ill fitted and ineffective compression garments may cause harm to a patient

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**Compression Garments**

- Different levels of compression dependent upon manufacturers
- <20 mmHg compression is not suitable in management of lymphedema
- Usually 20-40mmHg compression garments are used

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**Therapeutic Exercise: Benefits**

- Improved strength
- Decrease in resting heart rate
- Improved strength in bone, tendon and ligaments
- Decrease in body fat
- Physiological effects: increases blood capillary permeability, filtration, and lymphatic load of water
Exercise and Edema

- Most beneficial when compression is used
- Appropriate compression provides resistance to promote the muscle pump
- No specific exercise that is better or worse for edema management
- Do NOT overstress the patient with excessive exercise as this can cause microswelling

Lymphedema / Vasopneumatic Pumps

- Improper use of the pump can complicate lymphedema management
- Lymphedema pumps clear proximally first
- Typically best utilized for maintenance or in conjunction with treatment
- Good for venous hypertension

Taping Objectives

- Neurosensory: assist in restoring motor pathways and disrupt pain
- Structural: assist to improve soft tissue or joint impairments by inhibiting or facilitating
- Microcirculatory: promote movement of stagnant superficial fluid, remove irritants and improve oxygenation

Kinesiotaping Corrective Techniques

- Mechanical: improve stability or biomechanics
- Fascial: direct movement of fascia and decrease fascia limitations
- Space Correction: decrease pressure over target tissue
- Ligament/tendon: reduce stress on a ligament or tendon
- Functional: provide sensory stimulation to inhibit or facilitate a motion
- Circulatory/lymphatic: to reduce edema and promote movement of lymph

Application and Use

- Can use various types of taping to address particular needs
- Scar and fascial mobilization
- Edema and bruising management
- For lymphedema, typically in conjunction with full decongestive therapies

Specific Techniques

- Space correction lifting
  - 10-35% tension
  - Decrease pressure on target tissue
  - Create recoil and lift over target tissue
  - I, donut hole, web cut
- Circulatory and lymphatic correction
  - 0-20% tension
  - Fan cut
  - Anchor proximally toward healthy lymph node
  - Fan tails over congested area
Precautions for Taping

• Tape allergies
• Geriatric and conditions that cause premature aging
• Congestive heart failure
• Diabetes
• Kidney disease

Contraindications for Taping

• Tape allergies
• Fragile or healing tissue
• Open wounds
• Cellulitis or infection
• Malignancy site
• Coronary artery disease
• Deep vein thrombosis
• Pregnancy

Considerations before the application

• Skin should be cleaned, dry, and free of oils or moisture before application.
• Remove hair if needed
• Round edges
• Activate adhesive with rubbing
• Educate patient on wear time and care of tape

Other Tips

• If applicable, document the number of “blocks” used
• The objective of the tape
• Targeted muscle or muscle group
• Correlate back to function
• Discuss performance with and without tape

Evidence for Edema Management

• Bialoszewski et al 2009, RCT
  – 24 participants with lower extremity edema
  – Kinesiology taping + PT vs PT only
  – Decreases noted in the thigh with kinesiology taping
• Han-Je Tsai 2009
  – 41 participants with BCRL
  – Bandaging vs kinesiology taping
  – No difference in volume
  – Acceptance and adherence was better with kinesiology taping

Electrical Stimulation Parameters

• Goal: Treating for edema reduction
  – Muscle “milking”
  – Bipolar setup on muscle proximal to edema
  – Low frequency (1-10 pps)
  – Visible, comfortable muscle contraction
  – Elevate limb
  – 15-30 minutes with or without cold application
Parameters

• Goal: produce tetanic muscle contractions
  – Frequency: arbitrary 30-60pps
  – Mode: pulsed, on/off 1-5 or 1-3
  – Amplitude: arbitrary 1-500 V
  – Duration/width: arbitrary 5-30 min

Electrode Polarity

• Negative
  – Increases: Vascularity, Stimulation of fibroblastic growth, Collagen production, Epidermal cell migration
  – Inhibits Bacterial growth

• Positive
  – Increases macrophages
  – Promotes epithelial growth

Application

• Treatment should be 30-60 minutes
• Electrode type
  – rubber carbon, electro-mesh glove/sock
• Electrode arrangement
  – Large dispersive electrode with:
    • one, two, or four active electrodes (bifurcated)
    • Equal size (if more than one active electrode)
• Coupling media
  – gel or saline soaked sponge
  – Conductive spray

Precautions

• Burn
  – Excessive electrical density
  • Intensity too high for size of the active electrode
  • Direct metal contact

General Rehab Considerations

• Impaired mobility and function due to size of limbs
• Gait deviations
• Limited cardiovascular endurance and deconditioning

Approaches for Prevention

• Education, education, education
• Protect skin and perform inspections
• Appropriate progression of activities
• Avoid use of blood pressure cuff and needle sticks on involved limb
• Monitor and prevent rapid weight gain
• Manage physical changes with aging
• Avoid systemic or local events causing hyperemia
• Take caution with pressure changes
Common Edema Diagnosis and Recommended Interventions

<table>
<thead>
<tr>
<th>Diagnosis</th>
<th>Compression</th>
<th>Support Stockings</th>
<th>MLD</th>
<th>Skin Care</th>
<th>Endurance</th>
<th>Skin Education</th>
<th>Active Mobility</th>
</tr>
</thead>
<tbody>
<tr>
<td>CVI</td>
<td>X</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Secondary Lymphedema</td>
<td>X</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Lymphedema, CVI/lymphedema</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td></td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>CVI/lymphedema</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td></td>
<td>X</td>
<td>X</td>
</tr>
</tbody>
</table>

Adapted from Hamm and Perdomo.

Skin and Nail Care

- Edematous tissue become thickened and scaly, increasing risk for skin cracks and fissures
- Patients with lymphedema are susceptible to infection of skin and nails
- Streptococcus bacteria most common cause for infections in patients with lymphedema

General Skin Care Recommendations

- Soaps, moisturizers, and ointments: No fragrances, Hypoallergenic, Neutral or acidic pH scale
- Protect from trauma, keep skin clean and use bug spray and sunscreen
- Basic moist wound healing techniques in conjunction with lymphedema management

What if there is a wound?

General Wound Care Management

Wound depth

**Partial thickness**: skin loss involving the epidermis and upper layer of the dermis.
- Heals through re-epithelialization
- Tissue regenerated to original function

**Full thickness**: skin loss extending past papillary dermis. May include subcutaneous tissue, tendon, muscle, and bone.
- Heals by granulation tissue formation, contraction and eventual epithelialization from wound margin.
- Results in scar formation (70-80% strength of original)
- Tissue does not regenerate

Time to heal dependent on:

<table>
<thead>
<tr>
<th>Vascularity</th>
<th>Tissue Depth</th>
</tr>
</thead>
<tbody>
<tr>
<td>Full thickness: Distal</td>
<td>Full thickness: Proximal</td>
</tr>
</tbody>
</table>
Time to heal dependent on...

Geometric shape

Linear < Rectangular/Square < Circular

Implications for Mobility?

Full thickness Sacral Pressure Ulcer

Wound Healing Phases

<table>
<thead>
<tr>
<th>Stage</th>
<th>Minutes</th>
<th>Days</th>
<th>Weeks</th>
<th>Year(s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hemostasis</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Inflammation</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Proliferation</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Remodeling</td>
<td></td>
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</tr>
</tbody>
</table>

“Treat the whole patient, not the hole in the patient.”

Characteristics of Lower Extremity Ulcers

<table>
<thead>
<tr>
<th>Type</th>
<th>Cause</th>
<th>Pain</th>
<th>Location</th>
<th>Appearance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Arterial</td>
<td>Arteriosclerosis</td>
<td>Pain can be severe due to lack of blood flow.</td>
<td>Toes/fingers, Lower third of leg.</td>
<td>Defined borders, Dry necrotic, Little to no granulation. Hairless, cooler skin.</td>
</tr>
<tr>
<td>Venous</td>
<td>Venous Hypertension</td>
<td>Mild</td>
<td>Proximal to the medial malleolus.</td>
<td>Leg, borders, red wound base, heavy drainage, hemosiderin staining</td>
</tr>
<tr>
<td>Pressure</td>
<td>Prolonged pressure/Shear</td>
<td>Varies on structures involved.</td>
<td>Over bony prominences.</td>
<td>Varies depending on load/increp. May note discoloration Non-blanching erythema</td>
</tr>
<tr>
<td>Neuropathic</td>
<td>Diabetes (neuropathies)</td>
<td>None. Patients with an infection may experience pain.</td>
<td>Plantar Foot</td>
<td>Pale, pink base, moderate drainage, callosus tissue, atrophy, hammer toes.</td>
</tr>
</tbody>
</table>

Adapted from Hamm R. (2015)

Wound Bed Preparation (WBP)

Wound bed preparation is the management of a wound in order to accelerate endogenous healing or to facilitate the effectiveness of other therapeutic measures. Falanga, 2003

Principals of WBP:
- Identify the cause
- Patient centered approach
- Assess the wound
- Debridement
- Bacterial Control
- Moisture Balance
- Monitor rate of healing

Falanga, 2003

Sibbald, G. Et al., 2011
TIME Principles of Wound Bed Preparation
(International Advisory Panel on WBP)

<table>
<thead>
<tr>
<th>Tissue non viable or deficient</th>
<th>Infection or inflammation</th>
<th>Moisture imbalance</th>
<th>Edge of wound non advancing or undermining</th>
</tr>
</thead>
<tbody>
<tr>
<td>Defective matrix &amp; cell debris</td>
<td>High bacterial counts or prolonged inflammation</td>
<td>Desiccation or excess fluid</td>
<td>Non-migrating keratinocytes Non-responsive wound cells</td>
</tr>
<tr>
<td>↓ Debridement ↓</td>
<td>↓ Antimicrobials ↓</td>
<td>↓ Dressings, compression ↓</td>
<td>Biological agents, adjunct therapies, debridement</td>
</tr>
<tr>
<td>Restore wound base &amp; ECM proteins</td>
<td>Low bacterial counts and controlled inflammation</td>
<td>Restore cell migration, avoid maceration</td>
<td>↓ Stimulate keratinocyte migration</td>
</tr>
</tbody>
</table>

Objective: Necrotic Tissue Types

- **Nonviable Tissue**: necrotic tissue, cellular debris, senescent nonfunctional cells and bacterial biofilms
- **Eschar**: composed of dead skin or subcutaneous cells varies in color and texture. Not synonymous with a “scab”
- **Slough**: non-viable subcutaneous tissue and is a result of the body’s autolytic process to phagocytose dead cells

Moist Wound Healing

- **Necessary** for wounds to heal
- **Use** of appropriate dressings helps facilitate this balance
- **Constant monitoring/re-assessment** necessary to meet needs of changing wound environment

**Great Reference!**

Considerations When Selecting a Dressing

- **Dry wound** → Moisten it
- **Excessive drainage** → Absorb it
- **Necrotic wound** → Debride it
- **Granulating wound** → Protect it

Dressing Functions

- Absorb drainage
- Provide moisture (hydrate)
- Protect tissue
- Obliterate dead space
- Act as a barrier to bacteria
- Minimize/control odor
- Decrease pain
- Offer bacterial control

Absorbency Spectrum

<table>
<thead>
<tr>
<th>Gauze</th>
<th>Foam</th>
<th>Alginate</th>
<th>Hydrofiber</th>
</tr>
</thead>
<tbody>
<tr>
<td>Less Absorbent</td>
<td>More Absorbent</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Let’s Review

- How much drainage is typically associated with etiology listed?
  - Diabetic/Neuropathic
  - Venous
  - Arterial

- Use these options:
  - Little/Scant
  - Moderate
  - Heavy

“What Dressing Should I Use?”

- Various studies have done dressing comparisons
- Weak evidence
- No standard target populations used
- Most do more than basic wet to dry
- Some studies did show that there were differences in frequency of changes, financial burden and pain with dressings

Is There a Right Answer?

- Know the wound presentation and etiology
- What is the goal at hand?
- What is available at your facility?
- Who will be doing the dressing change?
- Frequency?
- Pain?
- Finances (insurance and CMS limitations)

Wound Dressings Categorized by Functionality

<table>
<thead>
<tr>
<th>Wound Dressing Function</th>
<th>Dressing Category</th>
</tr>
</thead>
<tbody>
<tr>
<td>Moisture maintenance</td>
<td>Transparent Films</td>
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<tr>
<td></td>
<td>Hydrocolloids</td>
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<tr>
<td>Moisture absorption</td>
<td>Foams</td>
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<tr>
<td></td>
<td>Alginites</td>
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<td></td>
<td>Hydrofibers</td>
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<tr>
<td>Moisture addition</td>
<td>Hydrogels</td>
</tr>
<tr>
<td>Reduce bacterial levels (antimicrobial)</td>
<td>Silver-containing dressings</td>
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<tr>
<td></td>
<td>Iodine-containing dressings</td>
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<tr>
<td>Reduce protease levels</td>
<td>Collagen dressings</td>
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<tr>
<td></td>
<td>Collagen-ORC dressings</td>
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<tr>
<td>Reduce odor</td>
<td>Activated charcoal additive</td>
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<tr>
<td></td>
<td>Cysteolactam additive</td>
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<tr>
<td>Reduce pain</td>
<td>Ibuprofen-containing dressing</td>
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<td>Soft silicone dressings</td>
</tr>
</tbody>
</table>

Importance of Monitoring

- One dressing/combo of dressings will NOT be appropriate from start to finish
- Documentation is EXTREMELY important so we can recognize changes as soon as they occur
- Wound changes noted in 2 weeks will help you decide

Documentation and Billing

- Policy: facility, National and local coverage determinations, conservative treatment considerations
- Billing: appropriate CPT, Ensure the policy covers the particular wound care being utilized
- Documentation: outcome measures (functional and self-report), photos, patient or caregiver education
Common Wound Care CPTs

Site to access most commonly used codes for wound and edema care:
www.apta.org/Payment/Coding/FAQs/ActiveWoundMgmt/

Site to reference for up to date changes on CPTs in general:
www.apta.org/Payment/Coding/CPTChanges/

All that info is great! But, can I really apply it?

Case Studies

References


Bettany JA, Fish Dr, Mendel FC. Influence of high voltage pulsed direct current on edema formation following impact injury. Phys Ther. 1990; 70: 219-224.


References


References


