LEARNING OBJECTIVES

By the end of this instruction you will be able to:

- Describe normal skin anatomy and physiology
- Identify the necessary components of skin assessment
- Describe proper strategies to preserve skin
  - Understand the purpose & use of the Braden Scale with ability to properly complete Braden Scale on selected case studies
  - Differentiate differences between Acute & Chronic Wounds
- Identify the three phases of wound healing
- Understand criteria for differentiating HAPU vs POA wounds
- Differentiate PU’s & Partial/Full Thickness wounds
- Identify & properly select generic product categories for various types of wounds

Skin.....The Largest Body Organ

- Comprises 16% of your total body weight
- It is the fastest growing organ in your body
- There are 19 million skin cells in one square inch of your body
- Skin thickness varies from 1 mm at your eyelids, to 4 mm on your palms and soles of your feet

Functions of Skin

- Protection
  - toxins
  - microbes
  - mechanical injury
- Sensation
  - nerve receptors (touch, heat, cold, socio-sexual & emotional sensations)
- Water Retention
- Thermoregulation
  - circulation
  - perspiration/sweating helps excrete toxic substances
- Synthesis of Vitamin D
- Expression of Emotion
# Normal Skin Structure

- Epidermis
- Dermis
- Adipose Tissue
- Muscle
- Bone

## Factors affecting wound closure...

### Extrinsic Factors

**#1 Factor affecting Wound Closure...**

- Bedsores vs Tedsores

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**Circulation**

- Originally designed for people at bedrest with even pressure throughout.
- New some gradient from maximum of 18 mmHg at heel less to thigh
- Evidence on reducing incidence of DVT (Joanna Briggs, 2008)
- Reinforcement at heel puts extra pressure on heel knee high equally effective
- MUST BE REMOVED for a period of time each shift

**Bedsores vs Tedsores**

- When stockings are not removed twice daily
- Ulcers can develop when stockings are applied to legs with poor perfusion
- Ulcers can develop
### Mechanical Stressors
- Pressure
- Friction
- Shear

### Debris in the Wound
- Necrotic material
- Old dressing residue
- Sutures
- Dog /cat hair

  - Sussman C and Bates-Jensen B, 2001

### Temperature
- Ideally wound temperature should be constant
- Can take the wound up to 5 hours to return to normal body temperature
- After cleansing
- After exposure to room
- Frequent dressing changes

  - Sussman C and Bates-Jensen B, 2001
  - Rolstad BS, Ovington LG and Harris A, 2000

### Moist Wound Healing
- Moist Healing
- Epidermal cells divide and migrate

- Maceration- over hydration of stratum corneum

- Dry Healing
- Desiccation- dryness of wound
- Epidermal cells have to burrow to moist surface to migrate.

  - Winter G, 1962
What is Maceration?

- Affects skin, not wound
- Skin not injured, but is more prone to injury
- Over-hydrated stratum corneum

Complications of excessively Moist Skin

- Maceration
- Denudation
- Fungal infections

Dry Wound Healing

- Prolongs inflammatory phase
- Causes additional tissue destruction
- Prolongs wound healing

Infection
### Chemical Stress

“What you permit, you promote!”

- Toxic to Fibroblasts
- Povidone Iodine (Betadine)
- Hydrogen Peroxide
- Hypochlorite (Dakin’s Solution)
- Alcohol
- Acetic Acid (Vinegar)
- Iodophor
- Trypsin/Balsam of Peru (Granulex)

- AHCPR Guideline, 1994

### Medications

- Anti-inflammatory
- Anti-coagulants
- Chemotherapy
- Antibiotics

### Factors affecting wound closure...

#### Intrinsic Factors

- Health Status/Disease
- Nutrition
- Age
- Body build
- Oxygen available to tissue

#### Health Status/Diseases

- Diabetes
- Immunocompromised
- Circulatory Status
### Nutrition
- Nutrients are essential in wound repair and prevention of infection.
- Protein, carbohydrates, fats
- Calories
- Vitamins
- Trace elements
- Fluids

### Aging
- Decreased inflammatory response
- Delayed angiogenesis
- Slower epithelialization
- Decreased function of sebaceous glands
- Decreased collagen synthesis
- Alteration in melanocytes (resulting in skin discoloration), “age spots”
- Thinning of all skin layers

### Body Build
- Obese People
- High risk of wound dehiscence
- Adipose tissue is poorly vascularized
- Thin people
- Less adipose tissue
- Less nutritional storage
- Both may be malnourished

### Oxygen available to tissue
- Must have oxygen to heal wounds
Patient Advocacy

- Do the right thing
- Familiarize yourself with national standards
- Promote best practice
- Make sure treatments are reasonable, necessary, appropriate
- Provide interventions within standards of care
- Document the right thing

Fraudulent Billing

“Physicians orders to apply Betadine on a routine basis to a patient's pressure ulcer may provide an excellent example of this type fraud. The application of Betadine to patients pressure ulcers is clearly outside standards of care for the treatment of pressure ulcers. Thus, if agency staff members render care ordered by the physician and submit a claim for payment for this care, the claim is false even though everything on the claim form is true because the services provided were not reasonable, necessary, and appropriate.”

Hogue E, 2003

Ineffective Treatments

Aloe vera
Vegetable shortening
Sugar
Mecurichrome
Cobwebs
Elase & baby powder
Clay
Wool
Linen bandages soaked in gum or boiled in wine or water
Gentian violet

Liquid antacid
Hydrogen peroxide
Urea
Chloroform
Bag Balm
Honey
Molasses
Syrup
Heat lamps
Povidone Iodine
Dakin's solution
Acetic acid
Compliance

• Taking care of noncompliant patients is unethical
• Removes resources from patients who want care
• Discharge noncompliant patients
• Steps to go through
  • Documentation
    • Monitoring
    • Reminding
    • Consulting
    • Supporting
    • Informing
    • Education
      • Hogue E, 2006

Two Key Components of Patient Assessment

Risk Assessment:
• Gather information about specific risk factors; both EXTRINSIC & INTRINSIC
• Determine the level of risk, if any
• Determine appropriate interventions to mitigate risk
• Target resources appropriately

Skin Assessment:
• Describe the current health of the integumentary system
• Detect variations from normal

Overall Management Goals:
• Identify individuals at risk for developing PU’s to initiate early prevention programs
• Implement appropriate strategies/plans to:
  • Attain/maintain intact skin
  • Promptly identify or manage complications
  • Optimize potential for wound healing
  • Involve patient/caregiver in self-management
  • Implement cost-effective strategies/plans that prevent & treat PU’s.
Groups that are at Increased Risk...

- Geriatrics
  - >65 years of age
  - >75 years of age are at even greater risk
  - Those who have sustained a fractured hip or who live in LTC facilities at increased risk for heel PU's

- Pediatrics
  - PU's often related to use of equipment/devices (i.e. wheelchair, prosthetics, casts, continuous positive airway pressure CPAP)
  - Neuropathic impairments (i.e. cerebral palsy, spina bifida, spinal cord injury & kyphoscoliosis

- Spinal Cord Injury (SCI)
  - at high risk with high rates of recurrence
  - Spasticity associated w/SCI might also increase the risk

- Critical Care Patients
  - Have shown to develop PU's within 72 hrs of admission, especially heel ulcers

Risk Assessment Tools

SCREENING TOOLS used for identifying patients at risk for developing ulcers:

- Norton Scale: (5 parameters with a 1-4 potential scores ranging from 5-20)
  - sensitivity = 73%–92%
  - specificity = 61%–94%

- Braden Scale:
  - sensitivity = 83%–100%
  - specificity = 64%–77%

Both recommended by Agency for Healthcare Research and Quality however Braden is the only tool validated in non-white populations

A head-to-toe skin assessment should occur on admission to care setting & at least daily per specific setting regulations. (Institute for Health Improvement (IHI), 2008; PVA, 2000) focusing on high risk areas such as bony prominences.

5 parameters for skin assessment are recommended by CMS (Centers for Medicare & Medicaid Services) include skin temperature, skin color, skin texture/turgor, skin integrity & moisture status (Armstrong et al., 2008; CMS, 2004)

Braden Scale for Adults

- Validated measurement tool
- Six sub-scales with descriptors provide a single numerical rating based upon 3 pressure ulcer risk factors
  - Pressure intensity
  - Pressure duration
  - Tissue tolerance for pressure
- The lower the number, the higher the risk
- Score < 9 is very high risk
- Score > 15 is mild risk
- Braden scale evaluates: sensory perception, moisture, activity, mobility, nutrition, and friction/shear

Risk Determines Action on Braden Scale

<table>
<thead>
<tr>
<th>Level of Risk (BQS)</th>
<th>Interventions and Actions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low Risk (15-18)</td>
<td>Are aimed at preventing situations that cause risk</td>
</tr>
<tr>
<td>Moderate Risk (13-14)</td>
<td>Are aimed at eliminating the risk factors if possible, and providing treatment as needed</td>
</tr>
<tr>
<td>High Risk (10-12)</td>
<td></td>
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<tr>
<td>Very High Risk (9 or &lt;)</td>
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</table>
Sensory Perception: Sub-scoring guidelines

Ability to respond meaningfully to pressure related discomfort

- **Completely Limited = Score of 1**
  - Unresponsive to painful stimuli (i.e., comatose, unresponsiveness, ventilator)
  - Limited ability to feel pain over most of body (i.e. quadriplegic, neuropathy)

- **Very Limited = Score of 2**
  - Responds only to painful stimuli by moaning or restlessness (i.e. over sedation, contractures)
  - Sensory impairment limits ability to feel pain over ½ of body (i.e. paraplegic, neuropathy)

- **Slightly Limited = Score of 3**
  - Responds to verbal commands (i.e. confusion, disorientation -cannot always respond to needs)
  - Has some sensory impairment which limits ability to feel pain

- **No Impairment = Score of 4**
  - Responds to verbal commands, no sensory deficits

Sensory Perception: Interventions

- Inspect 100% of skin every shift & PRN
- Pressure redistribution support surfaces (i.e. overlays, mattress replacements, transport/Procedure & ER/OR mattresses, chair cushion, etc.)
- Reposition every 2 hours regardless of mattress/bed type
- Reposition every 1 hour in chair
- Reduce pressure on areas of lost sensation (i.e. pillows, off-loading boots)
- Avoid hot water and heating pads
- Consider protection of feet and ears

Moisture: Sub-scoring Guidelines

Degree to which skin is exposed to moisture

- **Constantly Moist = Score of 1**
  - Skin is kept moist almost constantly by perspiration, urine, etc
  - Dampness detected each time patient repositioned

- **Very Moist = Score of 2**
  - Skin is often, but not always moist
  - Linen must be changed at least once per shift

- **Occasionally Moist = Score of 3**
  - Skin is occasionally moist
  - Requires linen change approximately once daily

- **Rarely Moist = Score of 4**
  - Skin is usually dry linen changed at routine intervals

Moisture: Interventions

- Address cause & offer bedpan/urinal/toileting Q2 hr
- Notify MD/Dietitian if patient has loose stools
- For history of incontinence, consider toileting Q2 hr
- Use absorbent pads that wick moisture away (avoid diapers/briefs)
- Skin care BID & after each incontinent episode using Ph neutral perineal products to bathe & protect
- Consider containment devices for frequent loose stools (i.e. foley, condom cath, rectal tube)
1. Draw a line down the center of the paper coffee filter
2. Spread a thin film of barrier cream on the left side of the coffee filter and let dry for 1 minute
3. Place the coffee filter on top of a paper towel
4. Taking the “red urine” in the cup provided, slowly pour the contents of the cup across the filter horizontally until it is all gone
5. Lift the filter and let it drip onto the paper towel
6. Observe the difference between the sides

Activity: Sub-scoring guidelines

- **Bedfast = Score of 1**
  Confined to Bed

- **Chair fast = Score of 2**
  Ability to walk severely limited or non-existent
  Cannot bear own weight, must be assisted to chair or w/c

- **Walks Occasionally = Score of 3**
  Walks occasionally during day for very short distances, with or without assistance, spends majority of time in bed or chair

- **Walks Frequently = Score of 4**
  Walks outside of room at least twice daily and inside room at least every two hours during waking hours

Activity: Interventions

- Inspect skin every shift
- Pressure redistribution support surfaces (i.e. overlays, mattress replacements, transport/Procedure & ER/OR mattresses, chair cushion, etc.)
- Reposition every 2 hours regardless of mattress/bed type
- Reposition every 1 hour in chair
- OOB if tolerated (as appropriate) at least TID
- PT/OT along with continued education to pt/caregiver on repositioning
You are a patient in the PACU who is waking up from a procedure, however your “inattentive RN” has left a syringe cap on your gurney underneath your arm. You are heavily sedated, have pain medication on board and had a nerve block in that arm, so right now, you cannot feel the cap, nor can you move or reposition your arm.....

1. Place the Lego on the table in front of your right or left forearm

2. Remove jacket, sweater or push sleeve up to expose plantar surface of forearm

3. Rest forearm directly on top of Lego block, applying only the weight of the arm, do not apply any additional force or pressure

4. DO NOT MOVE YOUR ARM, REPOSITION ARM, OR REMOVE Lego until instructed to do so by the classroom instructor

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**Mobility: Sub-scoring guidelines**

- **Completely Immobile = Score of 1**
  - Does not make even slight changes in body or extremity position without assistance
- **Very Limited = Score of 2**
  - Makes occasional slight changes in body or extremity position but unable to make frequent or significant changes independently
- **Slightly Limited = Score of 3**
  - Makes frequent thought slight changes in body or extremity position independently
- **No Limitation = Score of 4**
  - Makes major and frequent changes in position without assistance

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**Mobility: Interventions**

- Assess for mobility-Immobility is the MOST significant risk factor for PU development
- Inspect 100% of skin every shift & PRN
- Pressure redistribution support surfaces (i.e. overlays, mattress replacements, transport/Procedure & ER/OR mattresses, chair cushion, etc.)
- Reposition every 2 hours regardless of mattress/bed type
- “Offload” patients who are sitting & can’t reposition themselves every 1 minute every 1 hour
- Utilize safe handling devices for transfers… protects your patient and you too!
Which bed is “just right”??

- **Pressure Redistribution**
- **Prevention and Treatment of stage I & II**
- **500 # weight limit**

### Standard Hospital Bed

#### Surface Selection Grid:
- Mobility and/or Activity Subscales 2 or Less
  - Pressure Wound Prevention & Treatment
    - **MEMORIES OVERLAY**
      - Low air loss
      - Can be used on ED Gray
      - Treatment Stage 1 - III 2000 # limit
    - **DECUBITUS MATRASIS**
      - Low air loss
      - Treatment Stage 1 - III 2000 # limit
    - **DECUBITUS CHAIR**
      - For Patients with Mobility and Activity Scores less than 2, or 2 on ED Pressure Ulcers
      - Continuous pressure redistribution
      - Prevention/Treatment Stage 1 - III 2000 # limit

#### Linen Management
- **Fitted Sheet**
- **Lift Sheet**
- **Minimize Padding**
- **Wicking Disposable Pads**
- **Do NOT layer pads**

#### Nutrition: Sub-scoring guidelines

<table>
<thead>
<tr>
<th>Score</th>
<th>Description</th>
</tr>
</thead>
</table>
| 1     | Very Poor= Score of 1
  - Never eats a complete meal, takes fluids poorly
  - Rarely eats more than ½ of any food offered
  - Does not take dietary supplements that are offered
  - OR is NPO and or on IV fluids or C.L. for more than 5 days |
| 2     | Probably Inadequate = Score of 2
  - Rarely eats a complete meal and generally eats only about ½ of food offered, occasionally takes dietary supplements offered
  - OR receives less than optimal amount of liquid diet or T.F. |
| 3     | Adequate = Score of 3
  - Eats over ½ of most meals & occasionally refuses a meal but will usually take dietary supplements when offered
  - OR is on tube feeding or TPN regimen which meets needs |
| 4     | Excellent = Score of 4
  - Eats most of every meal, does not require supplementation |

![Image of a hospital bed](https://example.com/hospital-bed)
**Nutrition: Interventions**

- Respect patient’s dietary preferences
- Consult nutritional services and use supplements as needed (malnourished patients may be twice as likely to develop skin breakdown (Thomas et al, 1996)
- Include family/caregiver
- Monitor hydration
- Monitor Albumin levels: Albumin (3.5-5.0) provides total protein level 20 day half-life. Pre-Albunin total protein level (18-35) 2-3 day half-life

**Friction**

“the mechanical force of two surfaces moving across each other; it damages surface tissues, causing blisters and abrasions”

**Shearing**

“Tissue layers slide against each other, disrupts or angulates blood vessels”

**Friction & Shear: Sub-scoring guidelines**

Ability to respond meaningfully to pressure related discomfort

- **Problem = Score of 1**
  - Requires mod to max assist in moving
  - Complete lift without sliding is impossible
  - Frequently slides down in bed or chair, requires freq repositioning
  - Spasticity, contractures, or agitation leads to constant friction

- **Potential Problem = Score of 2**
  - Moves freely or requires minimum assist
  - During a move, skin probably slides to some extent against sheets, chair, restraints or other devices
  - Maintains relatively good position in chair or bed most of the time

- **No Apparent Problem = Score of 3**
  - Moves in bed or chair independently and has sufficient muscle strength to lift up completely during move.
Friction & Shear: Interventions

- Limit HOB elevation to <30 degrees (unless contraindicated)
- Use knee gatch PRN to keep patient from sliding
- Use trapeze PRN
- Use lift sheet or Hoyer to move patient and prevent lateral shift
- Minimize layers of linen underneath patient
- Avoid dragging/sliding during transfers
- Use pillows/wedges for repositioning on side
- Remove bedpans promptly
- Protect elbows & heels with skin barriers or dressings if exposed to friction
- Limit time sitting in chair if patient unable to reposition self

Pro-Active Prevention

- Placing a foam dressing on the sacrum after intubation has shown to reduce shearing injuries in ICU patients (Takahashi, 2008 & Brendle, 2009)
- When the HOB is elevated to help prevent VAP, forces are intensified on the sacrum and foam provides another “layer” of protection against shearing

LET’S PRACTICE! #1
CALCULATE BRADEN & DETERMINE THE INTERVENTIONS

Miss Betchell is an 89 year old woman who was admitted to the hospital five days ago with end stage Alzheimer’s and c-diff in her stool.

She is incontinent of bowel and bladder, managed with absorbent briefs. Her stool is liquid and she leaks constantly. She has been living at an extended care facility- they reported that she requires complete care, she has been bedfast for months, and she cannot eat on her own.

They had been feeding her mashed food multiple times per day. On the floor, she has been NPO for management of her stool. She does have an IV of D5NS at a rate of 100ml/hr.

When you see her, the head of the bed is up at 30 degrees, but she has slipped way down in the bed, and tipped sideways. She makes no effort to correct the position, nor does she respond to verbal commands or stimuli- she just stares into space.

LET’S PRACTICE! #1
ANSWER

- **Sensory perception- 1**
  - Completely limited. Although Miss Betchell does not suffer from paralysis, she has a significant cognitive defect and does not respond appropriately to stimuli
- **Moisture- 1**
  - Constantly moist. Miss Betchell leaks stool at all times and is also incontinent of urine
- **Activity- 1**
  - Bedfast.
- **Mobility- 1**
  - Completely immobile. Again, she may have the ability to move in bed, but she does not due to cognitive defect
- **Nutrition-1**
  - Very poor. Miss Betchell has been getting IV fluids only for 5 days, and she has been losing much through her frequent loose stool
- **Friction and Shear- 1**
  - Problem. Miss Betchell slides in bed and requires complete assistance to reposition

- **Total Score: 6- Very High Risk for skin breakdown**
Bill Rate, a 120 pound, 20 year old male, admitted to ICU because of an MVA.

He has a broken arm and cerebral edema. He is being chemically paralyzed to prevent further damage to his brain.

A foley catheter is in place and he is on a bowel program with incontinent formed stool every other day.

TPN is running 24 hours/day, with an albumin level of 3.6g/dl.

- **Sensory Perception- 1**
  - Completely limited. Mr. Rate has been chemically paralyzed

- **Moisture- 4**
  - Rarely Moist. Mr. Rate has a foley catheter and his bowel program manages incontinent stool.

- **Activity- 1**
  - Bedfast. Chemically paralyzed

- **Mobility- 1**
  - Completely Immobile; Chemically paralyzed

- **Nutrition- 3**
  - Adequate. TPN able to maintain a normal albumin level

- **Friction and Shear- 1**
  - Problem. Despite the fact that he only weighs 120 pounds, he is still a maximum assist, therefore at risk for friction and shear injury

**Total Score: 11. - High risk for skin breakdown.**
Skin Inspection…
Can we talk?

You cannot FEEL a stage I pressure ulcer or a DTI, and you can’t see them through stockings. Inspecting skin is about looking, feeling, and TOUCHING the patient.

Ways to Integrate Inspection into Assessment

• When applying O2
• During repositioning
• When auscultating lung sounds
• When checking bowel sounds
• When placing pillows under calves
• When checking IV sites
• When getting patient up
• When bathing

Chart your Interventions

Skin Interventions

- Moisturize the skin daily & PRN with lotion or cream
- Redistribute pressure (reposition, protect heels)
- Minimize exposure to moisture & keep skin clean
- Gently cleanse @ each time of episode w/pH-balanced cleanser
- Use skin barriers/protectants
  - avoid products w/humectants (urea, glycerin, alpha hydroxyl acids, & lactic acid). They retain water in the skin
- Establish a bowel/bladder management & retraining program
- Use of under-pads that wick moisture away from the skin vs trapping moisture against skin
- Provide appropriate pressure redistributing support surfaces
- Maintain or improve nutrition & hydration
- Monitor adverse drug reactions

Routine Skin Care for ALL Patients

Document each intervention that you perform for your patient during your shift.
Pressure Ulcers can start in many places:

- Usual surfaces of carts and chairs are not pressure redistributing.
- If cart has over 4 inches of foam as the mattress, there is some pressure redistribution.
- What happens when HOB is elevated?

**Patient Positioning**

- Repositioning plan
  - Lifting devices (hoyer, trapeze, draw sheet, lift team)
  - Avoid patient lying directly on wounds
  - Educate patient & family on why position changes are important
  - Change position regularly & monitor
  - Assist with position changes if patient cannot move self

**Positioning wedges**

- The Rule of 30
  - Wedges reposition patients hips and body at 30 degrees... off of the trochanter
  - HOB should be 30 degrees or less if possible (challenging in the intubated patient!)
  - Shoulders should be tilted 30 degrees from the plane of the bed

Keep heels off bed.
• Assess patient or caregiver knowledge of wound etiology, prevention strategies and treatment plan.
  • Instruct where knowledge deficit exists, including:
    • Mechanism of wound formation
    • Signs and symptoms of infection
    • Information on nutrition and hydration
• Wound/Skin Care
  • Provide patient education materials, as appropriate

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**When you or your family member were admitted to this facility, nurses performed a skin assessment. This assessment indicates that you are at risk for developing a pressure ulcer.**

**What is a Pressure Ulcer?**
A pressure ulcer, sometimes called a “bedsores,” is injury to the skin and underlying tissues usually caused by unrelieved pressure. These ulcers usually occur on the shoulders, elbows, hips, buttocks, and heels (areas covered by bony parts of the body that sustain pressure when lying in bed or sitting for long periods of time). They begin as reddened areas, but can damage skin and muscles if not treated properly.

**What causes a Pressure Ulcer?**
Pressure ulcers occur by applying sustained pressure on the skin, squashing tiny blood vessels which supply the skin with nutrients and oxygen. When the skin is starved of nutrients and oxygen for too long, the tissue dies and a pressure ulcer forms.

Pressure ulcers can also be caused by sliding down in a bed or chair. This stretches or tears blood vessels, causing pressure ulcers. Even slight rubbing or friction on the skin may cause minor pressure ulcers that can quickly worsen. Damage can range from discolored red skin to deep wounds down to the muscle or bone.

**Key steps to pressure ulcer prevention**

- **Limit Pressure**
  - If you are in a bed, your position should be changed at least every two hours.
  - If you are in a chair, your position should be changed at least every hour. If you are able to shift your own weight, you should do so every 15 minutes or while sitting.

- **Reduce Friction**
  - When sitting in position or moving in your bed, don’t pull or drag yourself across the sheets. Also, don’t push or pull with your hands.
  - Avoid repetitive movements such as rubbing your foot on the sheets to scratch an itchy spot.
  - Do not use straight or shaped cushions — they can actually cause injury to deep tissues.

- **Take Care of Your Skin**
  - A member of your health care team will inspect your skin at least once per shift.
  - If you notice any abnormal areas, notify your nurse as soon as possible.
  - Your skin should be cleaned thoroughly as soon as possible after contact with urine or stool.
  - Prevent dry skin by using ointments or oils.
  - Don’t rub or massage skin over bony parts of your body.

- **Safeguard Your Skin from Beschweren**
  - Avoid friction directly on your hip bones when lying on your side. Also, a position that spreads weight and pressure more evenly should be chosen if possible — pillows may help.
  - If you cannot move at all, pillows should be placed under your hips to help keep your heels off the bed. Never place pillows behind the knee.
  - Don’t forget to change your position frequently if you are able to shift your own body weight.
  - Remember that comfort and good posture are important.

**Nutrition**
Your physician may order extra nutritional supplements. It is important to take these steps since they help the body heal.

- Drinking plenty of water is important for the body to heal.

**If you are Confined to Bed for Long Periods of Time**
Your physician may order a special bed linens and mattress depending on your condition.

- Try to keep the head of your bed as low as possible (unless other medical conditions do not permit it). If you need to raise the head of the bed for comfort, try to raise it to the lowest point possible for as short a time as possible.

- Pillows may be used to keep your knees or ankles from touching the bed.

- Avoid holding anything on your hip bones when lying on your side. Also, a position that spreads weight and pressure more evenly should be chosen if possible — pillows may help.

- If you cannot move at all, pillows should be placed under your hips to help keep your heels off the bed. Never place pillows behind the knee.

- Don’t forget to change your position frequently if you are able to shift your own body weight.

- Remember that comfort and good posture are important.

**Improve your Ability to Move**
Your physician may order physical therapy to help you improve your ability to move.
WOUND CARE TERMS

**Eschar:** thick, leather-like, devitalized tissue. Black/Brown dry or wet

**Slough:** devitalized tissue that is in the process of separating from the viable portions of proximal skin. (Yellow, Tan or Gray)

**Granulation:** pink to red in color, new tissue that contains blood cells, collagen, inflammatory cells; fills wound beds when healing is occurring

**Epithelialization:** stage of healing in which new skin cells migrate across the wound bed, tissue appears “glassy” or “pearly pink” in color

**Maceration:** excess moisture to intact peri-wound skin. Tissue is overly softened by excess moisture. Appears whitish in color. Superficial layers of skin rub away easily leaving skin thinner than normal and at greater risk of breakdown.

Wound Care Terms

- Serous - clear
- Sanguineous - bloody
- Serosanguineous - serum & blood
- Purulent - contains puss
- Fluctuant - boggy, unstable
- Indurated - hard
- Recalcitrant - Resistant to healing
ACUTE WOUND

- Occur suddenly
- Are typically traumatic or surgical
  - Gunshot wound, stab wound, surgical incision, abrasions, etc.
- Heals within an expected time frame

Chronic Wounds

- Frequently caused by vascular compromise, chronic inflammation, or repetitive insults to the tissue
  - Mechanical
    - Pressure, friction, shear, trauma
  - Lower extremity wounds
    - venous, arterial, neuropathic/diabetic
  - Fail to heal close in timely manor
- Any wound that has not shown significant progress toward healing in 30 days

Types of Wound Closure

- Primary intention
  - fastest (i.e. surgical incision)
- Secondary intention (dehiscence)
  - Wound edges are not approximated, healing occurs by granulation tissue formation, contraction of wound edges, & epithelialization
- Tertiary intention (delayed primary intention)
  - Wound is kept open several days i.e. infected wounds left often & delayed surgical closure till bacterial load is reduced

Secondary Intention
### Phases of Wound Healing

- **Inflammatory phase**
- **Proliferative phase**
- **Maturation phase**

#### Inflammatory Phase

**1-3 days**

<table>
<thead>
<tr>
<th>Cellular Activities</th>
<th>Clinical Observation</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Injury occurs</em> (disrupts blood vessels, bleeding &amp; exposure of blood to collagen)</td>
<td>- Erythema</td>
</tr>
<tr>
<td><em>Hemostasis</em> (continued disruption &amp; release of histamine) <em>Stops bleeding</em></td>
<td>- Edema</td>
</tr>
<tr>
<td>*Coagulation pathways activated &amp; fibrin clot formed; platelets degranulated &amp;</td>
<td>- Warmth</td>
</tr>
<tr>
<td>release growth factors*</td>
<td>- Pain</td>
</tr>
<tr>
<td><em>Vasoconstriction results from Injury &amp; Hemostasis occurs</em></td>
<td></td>
</tr>
<tr>
<td><em>Platelet release prevent hemorrhage</em></td>
<td></td>
</tr>
<tr>
<td><em>Inflammatory Phase Vasodilatation</em></td>
<td></td>
</tr>
<tr>
<td><em>Leakage of plasma, neutrophils, &amp; macrophages</em> into the wound bed*</td>
<td></td>
</tr>
<tr>
<td><em>Leukocyte Migration</em></td>
<td></td>
</tr>
<tr>
<td><em>WBC's phagocytose bacteria and foreign material (debridement)</em></td>
<td></td>
</tr>
<tr>
<td><em>Macrophages</em></td>
<td></td>
</tr>
<tr>
<td><em>Initiate tissue repair process</em></td>
<td></td>
</tr>
</tbody>
</table>

**Clinical Observation**

- Erythema
- Edema
- Warmth
- Pain

#### Proliferative Phase

**aka “Rebuilding” 3-21 days**

<table>
<thead>
<tr>
<th>Cellular Activities</th>
<th>Clinical Observation</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Macrophages</em></td>
<td>- Granulation tissue</td>
</tr>
<tr>
<td>*Granulation and</td>
<td>- Beefy red</td>
</tr>
<tr>
<td>epithelialization*</td>
<td>- Cobblestone, bumpy,</td>
</tr>
<tr>
<td></td>
<td>red raspberry</td>
</tr>
<tr>
<td><em>Fibroblasts</em></td>
<td>- Epithelialization</td>
</tr>
<tr>
<td><em>Collagen synthesis</em></td>
<td>- Thin, silvery</td>
</tr>
<tr>
<td><em>Endothelial Cells</em></td>
<td>epithelial layer</td>
</tr>
<tr>
<td>*Formation of new</td>
<td>- Wound contraction</td>
</tr>
<tr>
<td>blood vessels ‘angiogenesis’*</td>
<td>- (shrinkage)</td>
</tr>
</tbody>
</table>
Proliferative Phase
3-21 days

Maturation Phase
aka Remodeling
21 days to beyond 1 year

- Cellular Activities
- Collagen remodeling
- Capillary regression
- Tensile strength increases

- Clinical Observation
- Contraction (shrinking)
- Thinning
- Paling of scar

All wounds can be classified as Partial or Full Thickness Wounds

Partial Thickness
- shallow (0.2cm)
- epidermal &/or partial loss of dermal layer
- moist red/pink base
- heel by epithelialization w/regeneration of epidermis/dermis w/NO granulation tissue
- 100% turgor w/no scar tissue

Full Thickness

Types of wounds:
Partial Thickness Wounds
Types of Wounds: Full Thickness

- Extends beyond epidermis and dermis
- May involve subcutaneous tissue, muscle and possibly bone which are never replaced!
- Beefy red base
- Heels by granulation w/epithelialization & contraction
- 80% turgor w/scar tissue

A Wound is considered “healed” when...

- Continuity of the skin is re-established and tissue strength is sufficient for normal activity.

Factors affecting wound closure...

- Effective communication
  - Must be clear, concise and complete
  - State your case with a possible solution
  - Communicating with physicians and other clinicians can be challenging
  - Negotiate needs

How resistant to change are you?
Pressure Ulcers

- Compresses capillaries
- Bony Prominences
- Deprives tissues of oxygen
- Tissue experiences
  - hypoxia
  - acidosis
  - cell death

Tissue Damage

- Time is NOT on our side
  - Time to development of a Stage I can be in as little as 12 minutes
  - Stage II can develop in 2 hours
Pressure Ulcer Definition

- A localized area of tissue necrosis that develops when soft tissue is compressed between a bony prominence and an external surface for a prolonged period of time. NPUAP, 1989
- Any lesion caused by unrelieved pressure usually over a bony prominence. AHCPR Pressure Ulcer Treatment Guidelines, 1994
- Any lesion caused by unrelieved pressure that results in damage to the underlying tissues. Although friction and shear are not primary causes of pressure ulcers, friction and shear are important contributing factors to the development of pressure ulcer. CMS Tag F314, 2004
- A pressure ulcer is localized injury to the skin and/or underlying tissue usually over a bony prominence, as a result of pressure, or pressure in combination with shear and/or friction. A number of contributing or confounding factors are also associated with pressure ulcers; the significance of these factors is yet to be elucidated. NPUAP, 2007

CMS Regulations

- Average extra cost when one pressure ulcer develops post-admission in acute care: $40,000!
- CMS no longer provides additional reimbursement to hospitals for patients who develop pressure ulcers after admission (HAPU)
- Patients with pressure ulcers are at an increased risk of death
- Pressure ulcers are reasonably preventable
- Skin assessment on admission and then daily

- This represents a real change for CMS, which is known for reimbursing for treatment services but not paying for prevention
- Hospitals which do not practice good preventive strategies face financial penalty if pressure ulcers occur
- Incentive to prevent pressure ulcers
### CMS Regulations: Acute care...

- Skin assessment by physician or licensed provider to document if the patient has pressure ulcers “present on admission” or POA
- Risk factors should also be assessed
- Holistic pressure ulcer prevention plan should be developed for individual patients
- No “cookie-cutter” plan fits all patients

### CMS Regulations: Long Term Care...

- CMS F-tags govern long-term care
- F-tag 314 addresses PU’s
- F-tag 314 states that residents who do not have a PU on admission should not develop one, unless the patient’s clinical condition demonstrates the PU was unavoidable
- F-tag 314 distinguishes between an “avoidable” and “unavoidable” PU

### CMS Regulations: Avoidable Pressure Ulcers...

- F-tag 314 will call a PU “avoidable” if the long-term care facility did not do these:
  - Evaluate resident’s clinical condition and assess risk factors for PU
  - Define and implement interventions consistent with resident needs, goals, and recognized standards of practice
  - Monitor and evaluate the impact of the intervention
  - Revise interventions, as appropriate

### CMS Regulations: Unavoidable Pressure Ulcers...

- F-tag 314 will call a PU “unavoidable” if the long-term care facility did these:
  - Evaluated the resident’s clinical condition and PU risk factors
  - Defined and implemented interventions consistent with resident needs, goals, or recognized standards of practice
  - Monitored and evaluated the impact of evaluations
  - Revised interventions, as appropriate
CMS Regulations: Home Care...

- Outcome Assessment Information Set (OASIS)
- Determine if patient has any skin lesion or open wound
- Document all pressure ulcers, if present
- Document if patient’s wound is
  - Fully granulating
  - Has early or partial granulation
  - Is non-healing

Only Wounds caused by pressure are staged...

- Stage I
- Stage II
- Stage III
- Stage IV
- Unstageable
- (Suspected) Deep Tissue Injury

Staging hints...

- The pressure ulcer should be staged according to the maximum anatomic depth of tissue damage
- Ulcer stage at the time of assessment may appear less than the stage documented in the patient’s record if the ulcer has started to heal
- If there is slough in the wound it’s at least a stage III
- Healing ulcers should not be reverse staged
- Stage III/IV/FT wounds are filled with granulation tissue (endothelial cells, fibroblasts, collagen, extracellular matrix)
- Ulcers do not replace lost muscle, subcutaneous fat, or dermis before re-epithelializing
- Stage II/PT wounds have NO undermining or tunneling

WHAT IS NOT..... A PRESSURE ULCER?

Blanchable Erythema is NOT a pressure ulcer

Reddened area that turns pale under applied light pressure.
**STAGE 1 Pressure Ulcer**

- Intact skin
- Non-blanchable redness of localized area usually over a bony prominence
- Darkly pigmented skin may not have visible blanching; its color may differ from the surrounding area
- Further Description: The area may be painful, firm, soft, warmer or cooler as compared to adjacent tissue. Stage I pressure ulcers may be difficult to detect in individuals with dark skin tones. May indicate “at risk” persons (a heralding sign of risk

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**STAGE 1... EXAMPLE**

- A reddened area is seen on the left heel.
- The skin surface is unbroken.
- No blistering of the skin is observed.
- Skin color remains unchanged after pressure is removed.

---

**Non-Blanchable Erythema???

- Skin color over the affected site is deeper in color than the surrounding skin.
- The skin surface is unbroken.
- The alteration in skin color persists after pressure is removed.

---

**STAGE 1... EXAMPLE**

- The ulcer appears as a defined area of redness that does not blanch (become pale) under applied light pressure.
- Purple or maroon localized area of discolored intact skin
**STAGE 1... EXAMPLE**

- A reddened area is seen on the infant’s left wrist.
- The skin surface is unbroken.
- No blistering of the skin is observed.
- Skin color remains unchanged after pressure is removed.

**STAGE 1... EXAMPLE**

- A persistent pink discoloration can be seen on the skin surface over the left trochanter.
- No blistering of the skin or loss of epidermis is noted.

**STAGE II PRESSURE ULCER**

- Partial thickness loss of dermis presenting as a shallow open ulcer with a red pink wound bed, without slough.
  
  May also present as an intact or open/ruptured serum-filled blister.

  Further description: Presents as a shiny or dry shallow ulcer without slough or bruising. This stage should not be used to describe skin tears, tape burns, perineal dermatitis, maceration or excoriation.
STAGE II...EXAMPLE

- This pressure ulcer is shallow with partial loss of dermis.

STAGE II...EXAMPLE

- This pressure ulcer is approximately 2 cm in length and 3 cm in width
- The epidermis has been lost in several areas
- Tissue surrounding the areas of epidermal loss are erythemic

STAGE II....EXAMPLE

- 2 month old baby
- The lesion is 2 cm in length, 2 cm in width
- The wound bed is pink
- Partial loss of dermis
- Excoriation of surrounding tissue

STAGE II....EXAMPLE

- Area of tissue loss over the right trochanter extends into the dermis and is in the form of a shallow crater
- The lesion is 3 cm in length, 1.5 cm in width and is approximately 0.1 to 0.2 cm deep
- The wound bed is pink
STAGE II...EXAMPLE

- Skin is reddened.
- Several intact serum blisters are located within the reddened area of skin.

STAGE III PRESSURE ULCER

- Full thickness tissue loss
- Subcutaneous fat may be visible but bone, tendon or muscle are not exposed
- Slough may be present but does not obscure the depth of tissue loss
- Stage III pressure ulcers may include undermining and tunneling
- Further Description: The depth of a stage III pressure ulcer varies by anatomical location. The bridge of the nose, ear, occiput and malleolus do not have subcutaneous tissue and Stage III ulcers can be shallow. In contrast, areas of significant adiposity can develop extremely deep Stage III pressure ulcers. Bone/tendon is not visible or directly palpable.

STAGE III ULCER ..EXAMPLE 1

- Sacral ulcer is approximately 2 cm by 3 cm in size
- Loss of epidermal and dermal layers exposes the underlying subcutaneous tissue
- The wound base is visible.
- No tunneling is noted

STAGE III ULCER...EXAMPLE 2

- The circled pressure ulcer is approximately 11 cm in length and 3 cm in width
- Subcutaneous fat is visible in the wound bed. No tendon, bone or muscle is visualized
- Slough is present at the left proximal wound edge. The slough does not obscure the depth of tissue loss
STAGE III ULCER...EXAMPLE 4

- The right sacral ulcer extends into subcutaneous tissue
- No muscle, bone, or tendon are exposed
- White macerated (overhydrated) tissue on wound edges

STAGE IV PRESSURE ULCERS

- Full thickness tissue loss with exposed bone, tendon or muscle
- Slough or eschar may be present on some parts of the wound bed
- Often include undermining and tunneling
- Further description: the depth of a Stage IV PU varies by anatomic location. The bridge of the nose, ear, occiput, & malleolus do not have subcutaneous tissue, & these ulcers can be shallow. Stage IV ulcers can extend into muscle &/or supporting structures (i.e. facia, tendon, joint capsule), making osteomyelitis possible. Exposed bone/tendon is visible or directly palpable.

STAGE IV.. EXAMPLE 1

- Pressure ulcer over the sacrum has exposed muscle tissue. Slough is present on parts of the wound bed. Undermining of the wound edge also is noted.

STAGE IV.. EXAMPLE 2

- Extensive loss of muscle tissue is noted in this very large pressure ulcer. The base of the wound is visible.
### UNSTAGEABLE

- Full thickness tissue loss in which the base of the ulcer is covered by slough (yellow, tan, gray, green or brown) and/or eschar (tan, brown or black) in the wound bed.

- Further Description: Until enough slough and/or eschar is removed to expose the base of the wound, the true depth, and therefore stage, cannot be determined. Stable (dry, adherent, intact without erythema or fluctuance) eschar on the heels serves as “the body’s natural (biological) cover” and should not be removed.

### UNSTAGEABLE.... EXAMPLE 1

- The sacral coccyxgeal ulcer measures 6.5 cm in width and 8 cm in length.
- Eschar completely covers the wound base.

### UNSTAGEABLE.... EXAMPLE 2

- Coccyx ulcer is covered with slough/eschar.

  - The wound bed is not visible.
  - Eschar covers the entire wound edges.

### Stable, Hard, Dry Eschar on Heels/Ischemic Limbs… Do NOT Debride
Important Points:

- Do not use the term “unstageable” to describe wounds of unknown etiology
- “Unstageable” is to be used only in reference to pressure ulcer wounds
- If the type of wound cannot be determined, the wound should be described…it’s okay to not know!

Deep Tissue Injury

- Proposed Etiology of DTI
  - Muscle injury associated with a decrease in nutrient supply
  - Pressure to the skin & soft tissue & ischemia
  - Injury or damage to the fascia from shearing injury or orison of the perforating vessels

Deep Tissue Injury

- Purple or maroon localized area of discolored intact skin or blood-filled blister due to damage of underlying soft tissue from pressure and/or shear
- The area may be preceded by tissue that is painful, firm, mushy, boggy, warmer or cooler as compared to adjacent tissue
- Further Description: DTI may be difficult to detect in individuals w/dark skin tones. Evolution may include a thin blister over a dark wound bed. The wound may further evolve & become covered by think eschar. Evolution may be rapid, exposing additional layers of tissue even with optimal treatment.
SUSPECTED DEEP TISSUE INJURY

- 15 month old with deep purple localized area of discolored intact skin

- Note the epidermal lifting
- Visualize the early blood blister formation

Deep tissue injury may be difficult to detect in individuals with dark skin tones.
- Evolution may include a thin blister over a dark wound bed.
- The wound may further evolve and become covered by thin eschar.

IS THIS A STAGE 1 ???
SUSPECTED DEEP TISSUE INJURY

- Color is key to the difference between DTI and a Stage I pressure ulcer
- Purple or maroon - DTI
- Non-blanchable redness – Stage I
- Determination of color is more difficult in dark skinned individuals
- If the DTI evolves into an open ulcer, it should be staged using the other stages

- Patients with DTI have spent time in one particular position
- Common locations are bony prominences on the pelvis and heels
- DTI over the heel may look like a bruise or a blood blister

OTHER TYPES OF WOUNDS

- DTI may evolve quickly exposing additional layers of tissue even with optimal treatment
- Some DTIs may heal with treatment and not breakdown

- Skin Tears
- Arterial Ulcers
- Venous Ulcers
- Diabetic Ulcers
- Perineal Dermatitis
SKIN TEARS

- Partial thickness loss resulting from separation of the epidermis from the dermis
- Usual Location is the arms, hands and legs

SKIN TEARS... RISK FACTORS

- Advanced age
- Sensory loss
- Dehydration/Malnutrition
- History of previous skin tears
- Cognitive Impairment
- Dependence in ADLs
- Steroid use
- Decreased estrogen levels
- Thin skin with loss of elasticity
- Surrounding edema purpura or ecchymosis usually occur on lower extremity!

SKIN TEAR....EXAMPLE

- Epidermal skin tear to the lower right arm
- Flap partially covers the wound
- Ecchymosis of surrounding skin

Arterial Ulcers aka Ischemic Ulcers

- Occur as a result of severe tissue ischemia/artery occlusion cause Pain (claudication)
- Represent potential limb loss
- Are prone to progress to invasive infection &/or gangrene; which may necessitate amputation
- LEAD (lower extremity arterial disease)
- Atherosclerotic disease is the most is the most common disease process affecting the arterial system
Arterial Ulcer: Characteristics

- Location
  - Tips of toes (spontaneous necrosis)
  - Pressure points (heel, lateral foot, maleolous) or areas of trauma (non-healing wounds)

- Wound Bed - Pale or necrotic
- Exudate - Minimal to dry
- Wound Edges - punched out; well defined
- Other - Infection common, but sx muted; typically painful & associated w/ischemia, diminished/absent pulses, elevational pallor (fair skin), dependent rubor or ashen tones (dark skin), thin fragile skin
  - Mottled or blue require immediate vascular referral

- Wound Assessment: Minimal exudate, pale or necrotic wound bed, well defined margins, black/purple/gray tissue.

Arterial Ulcer: Etiology

- Most common in older adults
- Middle aged adults w/additional risk factors (i.e. diabetes, tobacco use)
- Most common causative factor in these cases is atherosclerotic disease
- Critical Limb Ischemia refers to patients w/chronic (>2 weeks) ischemic rest pain, ulcers or gangrene

Arterial Ulcer: Risk Factors

- Smoking
- Diabetes
- Dyslipidemia
- Hypertension
- Obesity, inactivity, social isolation, stress
- advanced age, male gender, postmenopausal status, family history, African American ethnicity

Arterial Ulcer Diagnostic Tests

Non-Invasive

- ABI (Ankle-Brachial Index) 1.0-1.3 Normal or
- TBI (Toe-Brachial Index) <0.7 LEAD
- TcPO2 (Transcutaneous partial pressure of oxygen) obtain if ABI or TP cannot be performed due to calcification or amputation of ankle/toes
- SPP (Skin perfusion pressure) >30 mm Hg
- PVR (Pulse volume recordings
Venous Ulcers

A wound caused by decrease in blood flow return from the lower extremities to the heart

3 elements essential to normal venous function are competent valves, physical properties of the venous wall, and the normally functioning calf muscle pump of the 3 leg muscle pumps responsible for venous return in lower extremities (foot, calf, & thigh) the calf muscle is of greatest importance & generates highest pressure.

Venous Ulcer: Assessment

- General appearance
  - Trophic changes: lipodermatosclerosis (hardening; inverted “champagne bottle”), hemosiderin staining, varicosities, ankle blowout (painful clusters of tiny venous ulcers located near medial malleolous), Atrophie Blanche Lesions (smooth white plaques of thin “speckled” atrophic tissue, venous dermatitis
  - Edema: Present from ankle to knee; often pitting
- Pain
  - Dull aching
  - Exacerbates with dependency, improves with compression
- Wound Characteristics
  - Gaiter area
  - Exudative and shallow
  - Diagnostic evaluation: Duplex Ultrasound

Venous Ulcer: Risk Factors...

- Obesity
- Pregnancy
- Thrombophlebitis (DVT, pulmonary Embolism)
- Leg Trauma (i.e. fracture, hip or knee surgery, vein stripping)
- Thrombophilic conditions (protein S deficiency, protein C deficiency, factor V (Leiden mutation), which increase the coagulability of venous blood, thus increasing the risk of DVT, varicosities
- Calf muscle dysfunction (sedentary lifestyle, Occupations that require prolonged standing, musculoskeletal conditions that compromise calf muscle function (i.e. paralysis, arthritis), advanced age, reduced mobility, altered or ‘shuffling’ gait, arthroscopic surgery, injection drug use
### Venous Ulcers: Characteristics

- **Location**
  - Shallow (ulcers that are deep may have exposed tendon & are not likely to be of pure venous origin (Nelzen, 2007)
  - Moderate to High exudate
  - Dark red “ruddy” wound base or thin layer of yellow slough. Islands of eschar may be present
  - Irregular edges w/peri-wound maceration, crusting, scaling
  - Hemosiderin staining (Wipke-Tevis & Sae-Sia, 2004)

### Venous Ulcers: Management

- **Limb Elevation above heart 1-2 hrs BID and at sleep**
- **Exercise** - Normal function of the calf muscle pump is essential to venous return
- **Weight control** - Obesity interferes with venous return
- **Pharmacologic Therapy** - Diuretics & topical corticosteroids reduce edema & pain short term but offer no long term treatment. 3 meds that benefit management are: Trental, Micronized Purified Flavonoid Fraction (MPFF) & Horse Chestnut Seed Extract
  - Compression Therapy used to reduce hydrostatic pressure and aid venous return (Vowden & Vowden, 2006). GOLD STANDARD Treatment

### Venous Ulcer: Example

- Ulcer over the left tibia
- Irregular wound margins
- Bilateral brown discoloration of calf and ankle skin
- Note dry scaly skin of right leg
Diabetic Ulcers aka Neuropathic

- An ulcer often caused by sensory, motor, and autonomic neuropathy (neuropathic)

Diabetic Ulcers: Pathogenesis

- Peripheral Neuropathy
  - major contributing factor
- Structural foot problems
- minor trauma
- edema
- callous
- peripheral ischemia

Diabetic Ulcers: Risk Factors

- Absence of protective sensation
- Vascular insufficiency
- Structural deformities & callous formation
- Autonomic neuropathy causing decreased sweating & dry feet
- Long duration of diabetes
- Long history of smoking
- Poor glucose control
- Obesity

Diabetic Ulcers: Risk Factors

- Impaired vision
- Past history of ulcer or amputation
- Male gender
- Increased age
- Ethnic background w/high incidence of diabetes (Native American)
- Poor footwear inadequately protecting skin from high pressure
Diabetic Ulcers: Characteristics

- Usual Location
  - Metatarsal heads, tops of the toes, and the foot

- Associated Skin Assessment
  - Dry, cracked skin
  - Warm skin
  - Decreased sensation (neuropathy)

- Associated Wound Assessment
  - May resemble laceration, puncture or blister w/rounded or oblong shape
  - Necrotic, pink, or pale wound base
  - Well defined, smooth edges
  - Small to moderate serous or clear drainage
  - Peri-wound skin often presents as a callous

Diabetic Ulcer Example

- Ulceration over the metatarsal head on the fifth toe, right foot
- A narrow band of callus surrounding the wound
- Regular wound margins
- Warm surrounding skin

Perineal Dermatitis: aka (IAD) Incontinent Associated Dermatitis

- Usual Location
  - Perineum, buttocks and upper thighs

- Associated Skin Assessment
  - Mild erythema of the skin to dark red skin
  - Deepened skin color in persons with darker skin

- Associated Wound Assessment
  - Blistering and erosion and serous exudate
  - Secondary infection such as Candida Albicans

Perineal Dermatitis/IAD Pressure Ulcer Location
- Not necessarily on bony prominence. Diffuse, in skin folds
- Usually over coccyx, sacrum, ischial tuberosity bony prominences

Pattern of Redness
- Red to bright red Extends to anterior perineum/ upper thighs
- Red to bluish/purple Surrounding pressure area

Loss of Tissue
- None or Erosion of the skin typically limited to the epidermis
- May be present & Tissue loss can extend to muscle/bone

Wound Characteristics
- Exudate Vesicle or scaly plaque formation with infection

Surrounding Tissue
- May be edematous
Perineal Dermatitis aka IAD

- Skin irritation that occurs most commonly from urinary or fecal incontinence
- Leads to inflammation, erosion and/or secondary infection

Perineal Dermatitis aka IAD

- Dermatitis with complicating secondary infection of candida (yeast)

TIME TO BREAK!

“Should’ve thought of that before we left. Next rest stop is 4.2 light-years away.”
### Product Selection:
Remember the “P’s” when caring for wounds...

- Keep it simple and clear
- Involve the patient, caregiver and clinical staff
- Assess perfusion status
- Focus on mobility & pressure redistribution
- Assess protein levels/provide supplementation
- Assess and protect the periwound skin
- Choose the products that supports the wound and the situation (pain free)
- Paperwork - document! document!

### Decreased time to wound healing
- Pain reduction
- Improved quality of life
- Prevention of recurrence/complications
- Ease of use
- Decreased costs

### Principals of Wound Healing

#### Dressing selections based on five principles of WOUND healing

1. **Is the Wound healing?**
   - Yes - proceed with best practice treatment
   - No - consider
     - Other etiologies
     - Care modalities
     - Comorbidities
     - Bioburden
     - If the wound needs to be “kick started”
     - Pain

2. **#1 WOUND healing principle**
#2 WOUND healing principle

- Optimal amount of moisture and Odor
- If it is wet, absorb it
- Drainage beyond inflammatory phase
- Odor
- If it is dry, moisten it
- If optimal moisture, maintain
Moist wound healing

- Moist healing
- Epidermal cells divide and migrate

- Dry healing
- Epidermal cells have to burrow to moist surface to migrate

Winter G, 1962

Benefits of Moist Wound Healing

- Faster healing
- Less scarring
- Increased comfort
- Less pain
- Decreased bioburden

#3 WOUND healing principle

Understand the periwound skin

- If it is compromised, avoid adhesives
- If it is not compromised, adhesives may be acceptable
- Assess edema, edges
- Consider use of protective products and adhesive removers to address injury and pain
#4 Wound Healing Principle

- Is the tissue Necrotic or viable?
- If it is necrotic, debride it, if debridement is consistent with overall patient goal
- If it is viable, support it
- Appropriate wound cleansing
#5 Wound Healing Principle

- Is there Depth or Dead space?
  - If it is deep, fill it
  - If it is flat, cover it

What do you do?

Assess the wound:
Identify the goals

Assess the treatment:
Will it achieve the goals?
Dressing Categories

- Antimicrobials
- Collagen
- Growth Factors
- Bioengineered Skin
- Polyacrylate
- Transparent films
- Hydrocolloids
- Hydrogels
- Alginates
- Foams
- Secondary dressings

Silver Products

- Arglaes (Medline)
- Acticoat (S & N)
- Actisorb (J & J)
- AgIE-GRX (Geritrex)
- Algidex (DeRoyal)
- Aquacel Ag (ConvaTec)
- Contreet (Coloplast)
- Gentell Hydrogel Ag (Gentell)
- Maxorb Extra Ag (Medline)
- Optifoam Ag (Medline)
- Polymem Silver (Ferris)
- Prisma (J & J)
- Seasorb (Coloplast)
- SelectSilver (Milliken)
- SilverCel (J & J)
- Silverlon (Argentum)
- Silver Seal (Noble)
- Silvasorb (Medline)
- Tegaderm Ag Mesh (3M)
Silver Dressing

Things to consider:
- Ionic vs. metallic
- Continuously vs. bolus
- Enough silver to kill bacteria
- Non-cytotoxic to wound and host
- Activate silver release by:
  - Moisture from skin
  - Moisture from atmosphere
  - Added external moisture

Antimicrobials
- Cadexomer iodine
- Iodoflex / Iodosorb (Smith & Nephew)
- CHG (Chlorhexidine gluconate)
- Biopatch (J & J)
- Gentian violet/methylene blue
- Hydrofera blue (Hydrofera)
- PHMB (polyhexamethylene biguanide)
- XCELL AM (Xylos/Medline)
- Kerlix AMD (Kendall)

Collagen Dressings
- Catrix (Lescarden)
- Cellerate (Wound Care Innovations)
- ColActive (Smith & Nephew)
- Fibracol Plus (J&J)
- Medifil Particles (Biocore)
- NuGel (J & J)
- Promogran / Prisma (J & J)
- Puracol / Puracol Plus (Medline)
- Skin Temp (Biocore)
Collagen Dressings

- Collagen
  - major protein in human tissues
- Patients with insufficient protein stores, or systemic impediments to healing may benefit from topical collagen
- Supports all phases of healing
- growth of granulation, enhances epithelialization and contraction

Growth Factors

- Growth factors are responsible for enhancing a single cellular process
- Autologus
- AutoloGel/Procuren (Cytomedix)
- Regranex (J & J)

Regranex Rx

- Recombinant, off-the-shelf platelet-derived growth factor (PDGF)
- Enhances formation of granulation tissue
- Lower extremity neuropathic/diabetic ulcers that are full thickness, and have adequate blood supply
- Surgical debridement prior to use
Polyacrylate Dressings

- Polymer gel encased in non-adherent polypropylene material
- Activated with Ringer’s solution
- Attracts protein molecules from wound

Day 1

Day 6

1/13/99
Transparent Films

- Bioclusive (J & J)
- Mefilm (Molnlycke)
- Opsite (Smith & Nephew)
- Polyskin (Kendall)
- Suresite (Medline)
- Tegaderm (3M)

- Create optimal moisture in dry to moist wounds
- Autolytic debridement
- Supports growth of viable tissue
- Waterproof/bacterial barrier
- Adhesive
- Has 100% memory do not s-t-r-e-t-c-h while applying
- Semipermeable
- Transparent
# Product Selection Guide (based on fluid handling)

## Drainage Amount

<table>
<thead>
<tr>
<th>DRESSING</th>
<th>DRY/NO DRAINAGE</th>
<th>MOIST/MINIMAL</th>
<th>MODERATE</th>
<th>HEAVY</th>
</tr>
</thead>
<tbody>
<tr>
<td>Transparent Film</td>
<td></td>
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<td></td>
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</tr>
</tbody>
</table>

- **Transparent Films**
  - Wear Time
  - Up to 7 days wear time
  - Moisture level is appropriate if the drainage stays within the confines of the wound edges
### Product Selection Guide (based on fluid handling)

<table>
<thead>
<tr>
<th>Dressing Category</th>
<th>Drainage Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td>Transparent Film</td>
<td>Dry/No Drainage</td>
</tr>
<tr>
<td>Hydrocolloid</td>
<td>Thin</td>
</tr>
</tbody>
</table>

### Hydrocolloids

- Comfeel (Coloplast)
- DuoDerm (Convatec)
- Exuderm (Medline)
- Hydrocol (Bertek)
- Replicare (S & N)
- Restore (Hollister)

Hydrocolloids

- Create optimal moisture in dry to moderately draining wounds
- Autolytic debridement
- Supports growth of viable tissue
- Waterproof/bacterial barrier
- Adhesive
- Decreases rate of infection
Amorphous Hydrogels

- CarrasynV Gel (Carrington)
- Curasol (Healthpoint)
- Intrasite Gel (S & N)
- NormLgel (Molnlycke)
- SilvaSorb (Medline)
- Skintegrity (Medline)
Hydrocolloids

- Create optimal moisture in dry to moderately draining wounds
- Autolytic debridement
- Supports growth of viable tissue
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Product Selection Guide (based on fluid handling)

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<tr>
<td>Hydrocolloid</td>
<td></td>
<td></td>
<td></td>
<td>STANDARD</td>
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<tr>
<td>Hydrogel</td>
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</tr>
</tbody>
</table>

Amorphous Hydrogels

- Create optimal moisture in dry to moderately draining wounds
- Autolytic debridement
- Supports growth of viable tissue
- Waterproof/bacterial barrier
- Adhesive
- Decreases rate of infection

- Creates optimal moisture in dry to moist wounds
- Autolytic debridement
- Supports growth of viable tissue
<table>
<thead>
<tr>
<th>Amorphous Hydrogels</th>
<th>Hydrocolloids</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Wear time issues</td>
<td>• Create optimal moisture in dry to moderately draining wounds</td>
</tr>
<tr>
<td>• Change at least every three days, as necessary to maintain an optimally moist wound bed</td>
<td>• Autolytic debridement</td>
</tr>
<tr>
<td>• Apply gauze dampened with NS, then apply secondary dressing</td>
<td>• Supports growth of viable tissue</td>
</tr>
<tr>
<td>• When necrotic tissue hydrates and become softer, and/or mushy, change dressing</td>
<td>• Waterproof/bacterial barrier</td>
</tr>
<tr>
<td></td>
<td>• Adhesive</td>
</tr>
<tr>
<td></td>
<td>• Decreases rate of infection</td>
</tr>
</tbody>
</table>
Amorphous Hydrogels

5 Days Later

Hydrogel Sheets (Solids)

- ClearSite (NDM)
- Dermagel (Medline)
- NuGel (J&J)
- Skintegrity (Medline)
- Vigilon (Bard)
# Product Selection Guide (based on fluid handling)

<table>
<thead>
<tr>
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<tbody>
<tr>
<td>Transparent Film</td>
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<tr>
<td>Hydrocolloid</td>
<td>THIN, STANDARD</td>
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<tr>
<td>Hydrogel</td>
<td></td>
</tr>
<tr>
<td>Hydrogel Sheet</td>
<td>WATER-BASED, GLYCERIN-BASED</td>
</tr>
</tbody>
</table>

## Hydrogel Sheets

- Creates optimal moisture
- Performs autolytic debridement
- Supports growth of viable tissue
- Excellent when gentle adhesion is required
- May cut to fit

**Hydrolge Sheets**

- Weartime Issues
- Up to 5 days depending upon drainage
**Hydrogel Sheets**

**Alginates**

- Curasorb (Kendall)
- Kaltostat (ConvaTec)
- Maxorb Extra (Medline)
- Melgisorb (Molnlycke)
- Sorbsan (Bertek)

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**Product Selection Guide** *(based on fluid handling)*

<table>
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<tr>
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<th>Heavy</th>
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<td>Hydrogel Sheet</td>
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<td>Glycerin-Based</td>
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<tr>
<td>Alginates</td>
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</tbody>
</table>

**Alginates**

- Moderate to heavy drainage
- Autolytic debridement
- Supports growth of viable tissue
Alginates

Wear time issues
- As drainage indicates by “strike through” on secondary dressing, or at least every five days
- If used in combination with foams the wear time may increase, decreasing the frequency of dressing change

Limitations
- Should not be used on dry to minimally draining wounds
- Do not fill cavity/tunnel/dead space unless can realistically be retrieved
### Alginates

- Allevyn (Smith & Nephew)
- Hydrasorb (Kendall)
- LYOfoam (ConvaTec)
- Optifoam (Medline)
- Polymem (Ferris)

### Foams
- Appropriate to moderate heavy drainage
- Autolytic debridement
- Supports growth of viable tissue

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#### Product Selection Guide (based on fluid handling)

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<tr>
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</table>
| • Wear time Issues  
• Up to seven days, or as drainage indicates by “strike through”  
• If used as a secondary dressing in combination with alginates may increase wear time and decrease frequency of dressing change | • Limitations  
• Should not be used in conjunction with a hydrogel  
• Not appropriate for dry wounds |
**Product Selection Guide** (based on fluid handling)

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</tr>
<tr>
<td>Secondary</td>
<td>COMPOSITE / BORDERED GAUZE</td>
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</table>

**Secondary Dressings**

- **Composite Dressings**
  - Alldress (Molnlycke)
  - Covaderm Plus (DeRoyal)
  - CovRsite Plus (Smith & Nephew)
  - Stratasorb (Medline)
  - Versiva (ConvaTec)

- **Bordered Gauzes**
  - Bordered Gauze (Medline)
  - Covaderm (DeRoyal)
  - CovRsite (Smith & Nephew)
  - Bordered Gauze (Gentell)
If you can’t use tape...

- Self-adherent wraps
- Elastic netting
- Dressing retention sheet
- Tubular bandage

Compression

- CircAid Plus (Coloplast)
- Fourflex, Threelflex (Medline)
- Medigrip (Medline)
- Profore, Profore Lite (Smith & Nephew)
- Setopress (ConvaTec)
- Stockings (Carolon, Jobst)
- Tubigip (ConvaTec)
- Unna Boot (various brands)

Arterial perfusion must be adequate
- ABI .8 or greater
- Requires training as there is a potential for under or over compression
- Various levels of compression available

Goals of Topical Product Selection

- Choose a dressing that keeps the surrounding skin intact and dry while keeping the wound bed optimally moist
- Remove nonviable tissue
- Eliminate infection
- Eliminate dead space
- Manage exudate
- Prevent cross contamination
- Provide insulation
- Protect from trauma
Non-Healing Wounds

- Pressure
- Non adherence to care plan
- Edema
- Systemic disease
- Malnutrition
- Cytotoxicity
- Foreign body
- Bacterial contamination
- Osteomyelitis
- Infection
- Inadequate circulation or perfusion
- Inappropriate product selection

TEST

- Multiple areas of dermal skin loss are noted over the sacrum and coccyx.
- Reddened area surrounds the areas of skin loss but does not extend anteriorly.

TEST Answer

- Multiple areas of dermal skin loss are noted over the sacrum and coccyx.
- Reddened area surrounds the areas of skin loss but does not extend anteriorly.
**TEST**

- Ulcer is located at and slightly above the right medial malleolus.
- Thickened, brown discolored skin is noted around the lower calf, ankle and proximal foot.
- Skin proximal and distal to the wound is reddened.

**TEST Answer**

- Ulcer is located at and slightly above the right medial malleolus.
- Thickened, brown discolored skin is noted around the lower calf, ankle and proximal foot.
- Skin proximal and distal to the wound is reddened.

**VENOUS ULCER**

- Tissue loss over left buttock measures 5cm by 2.5 cm.
- Most of the wound bed is pale to dark pink. A small area of subcutaneous tissue can be visualized in the wound bed.

**TEST Answer**

- Tissue loss over left buttock measures 5cm by 2.5 cm.
- Most of the wound bed is pale to dark pink. A small area of subcutaneous tissue can be visualized in the wound bed.

**STAGE III**
TEST

- Multiple ulcerations are noted over the anterior surface of the left foot and toes.
- Ulcerations over the anterior surface of the left foot extend to tendon and bone.
- The fifth toe has been removed.
- Left lower extremity pulses are diminished to absent.
- Surrounding skin is cool.

TEST Answer

- Multiple ulcerations are noted over the anterior surface of the left foot and toes.
- Ulcerations over the anterior surface of the left foot extend to tendon and bone.
- The fifth toe has been removed.
- Left lower extremity pulses are diminished to absent.
- Surrounding skin is cool.

ARTERIAL ULCER

- Area of tissue loss is noted over the coccyx.
- Subcutaneous tissue is visible in the wound bed.
- No muscle, tendon or bone is exposed.

TEST

- Area of tissue loss is noted over the coccyx.
- Subcutaneous tissue is visible in the wound bed.
- No muscle, tendon or bone is exposed.

TEST Answer

- Area of tissue loss is noted over the coccyx.
- Subcutaneous tissue is visible in the wound bed.
- No muscle, tendon or bone is exposed.

STAGE III
• This 81 year old woman has multiple ulcerations over the right lower calf and ankle.
• Skin is more deeply pigmented above and below calf ulceration.
• Lower leg and ankle edema are noted

VENOUS ULCER

• right heel ulcer.
• Eschar and slough cover the wound bed.

UNSTAGEABLE
TEST

- This pressure ulcer is located over the coccyx.
- The skin is reddened. The area does not blanch under applied light pressure.
- The epidermis remains intact. No blistering of the skin is observed.

TEST Answer

- This pressure ulcer is located over the coccyx.
- The skin is reddened. The area does not blanch under applied light pressure.
- The epidermis remains intact. No blistering of the skin is observed.

STAGE I

TEST

- Ulceration is located over the metatarsal head on the first toe of the right foot.
- A band of callus surrounds the wound.
- Wound margins are regular.

TEST Answer

- Ulceration is located over the metatarsal head on the first toe of the right foot.
- A band of callus surrounds the wound.
- Wound margins are regular.

DIABETIC ULCER
Areas of purple and maroon discolored skin are located over the sacrum.

Skin surface is intact.

Tissue loss over heel extends into subcutaneous tissue.

Wound measures 2.7 cm by 3.5 cm and is 0.5 cm deep.
• The ulcer of this 79 year old is located on the bottom of the foot.
• Neuropathic changes have altered normal right foot contours (Charot’s Foot).
• Wound margins are regular.
• The wound bed contains necrotic tissue.
• Skin around the wound is reddened.

• Areas of skin redness and scaling that extend anteriorly to the perineum

• The ulcer of this 79 year old is located on the bottom of the foot.
• Neuropathic changes have altered normal right foot contours (Charot’s Foot).
• Wound margins are regular.
• The wound bed contains necrotic tissue.
• Skin around the wound is reddened.

• Areas of skin redness and scaling that extend anteriorly to the perineum
Area of skin loss to dermis tissue is noted over the right heel.
The wound bed is visible.

Reddened area over the left heel does not blanch with lightly applied pressure. No underlying area of purple or maroon discoloration is noted.

Area of skin loss to dermis tissue is noted over the right heel.
The wound bed is visible.

Reddened area over the left heel does not blanch with lightly applied pressure. No underlying area of purple or maroon discoloration is noted.
In the center of the ulcer is a localized area of deep purple tissue. Surrounding the deep purple center is an area of non-blanchable redness. Skin surface is intact.

Multiple areas of tissue loss from pressure are noted over the buttocks and upper thighs. Circled pressure ulcer extends to muscle. Bone involvement cannot be determined. Slough/eschar covers part of the wound bed.

Multiple areas of tissue loss from pressure are noted over the buttocks and upper thighs. Circled pressure ulcer extends to muscle. Bone involvement cannot be determined. Slough/eschar covers part of the wound bed.

DEEP TISSUE INJURY

STAGE IV
Ulcer is located on the left medial leg at midcalf. Brown discoloration of the lower leg/ankle and dry skin are noted.

Area of tissue loss extends into subcutaneous tissue.
Wound is 5 cm in length, 3 cm in width and 0.6 cm in depth.
Wound bed contains granulation tissue.

VENOUS ULCER

STAGE III
WHY ARE WE HERE TODAY?

It’s in YOUR hands!

Team Approach...

- Caring for PU often requires a multidisciplinary approach
- Patient and family
- Attending physician
- Nursing team (RNs, nurse assistants, nurses aides, etc.)
- Physical therapist
- Occupational therapist
- Wound care specialist
- Dietitian

How can you help???

- PU prevention is not difficult
- Systematic approach
- Teamwork- YOU are part of the team
- Awareness

REMEMBER…..

You have brains in your head.
Your have feet in your shoes.
You can steer yourself in any direction you choose.
You’re on your own.
And you know what you know.
And YOU are the guy who’ll decide where to go.

…… Dr. Seuss