LEARNING OUTCOME AND OBJECTIVES: Upon completion of this continuing education course, you will have increased your understanding of pressure injury assessment, prevention, and treatment. Specific learning objectives to address potential knowledge gaps include:

- Discuss the impact of pressure injuries on individuals, healthcare facilities, and society.
- Explain the risk factors for developing pressure injuries.
- Describe the process of conducting risk assessments and measuring risk associated with pressure injuries.
- Identify actions to help prevent pressure injuries.
- Describe the staging of pressure injuries.
- Discuss effective wound treatment and management of pressure injuries.
- Describe the factors affecting pressure injury healing.
- Explain the essential information for documentation of pressure injuries in the patient record.

INTRODUCTION

When individuals, including healthcare clinicians, are asked about organs in the human body, their responses range from brain, heart, lungs, liver, to kidneys. However not many healthcare professionals stop to consider the skin as an organ. The skin is in fact the largest organ in the human body—and essential to life and well-being.

Human skin serves many vital functions, the most critical of these being to provide a barrier between the external environment and the internal environment of the body. Similar to any other
organ in the body, the human skin is susceptible to disease and injury. Wounds involving the skin are a frequent occurrence in all age groups.

A pressure injury is a wound unlike any other, in that its cause is not surgery or trauma but death of the skin and underlying tissues from ischemia due to intense and/or prolonged pressure. A pressure injury can also result from a combination of pressure and shear. There are many factors that contribute to the development of a pressure injury and whether or not it will heal, but the biggest factor in all of these is pressure.

Pressure injury is not new, and the terminology to describe it has varied over time:

- Decubitus (18th century)
- Decubitus ulcer (ca. 1950s)
- Bed sore (ca. 1970s)
- Pressure sore (ca. 1980s)
- Pressure ulcer (ca. 1990s)
- Pressure injury (2016–present)

(PT DOH, 2017)

**Defining “Pressure Injury”**

The four-stage progressive classification of pressure injury, which became the gold standard for healthcare clinicians, was created in 1975 by Dr. J. Darrell Shea, who was an orthopedic surgeon and spinal injury specialist (Levine, 2019). Over the years, the definition of a pressure injury has been refined as medical knowledge and understanding of the disease process has advanced, along with improvements in treatment approaches and imaging technology.

In April 2016, the National Pressure Injury Advisory Panel (NPIAP) (at that time called the National Pressure Ulcer Advisory Panel, or NPUAP) updated the term *pressure ulcer* to *pressure injury*, updated the staging system, replaced the use of Roman numerals with Arabic numerals, and updated the definition of a pressure injury. This process of change started in 2014 when a task force was set up by the NPIAP to evaluate the existing staging terminology. One prominent outcome of the task force review was the adoption of the term *pressure injury* instead of *pressure ulcer*. The two main reasons cited for this change were:

- Stage 1 pressure injuries and deep tissue injuries were never ulcers.
- An ulcer cannot be present without an injury, but an injury can be present without an ulcer.

The overriding aim of the changes was to encompass the current knowledge of the causes of pressure injuries, along with clarifying the anatomical characteristics existent or nonexistent in each stage of injury (Edsberg et al., 2016).
The **NPIAP definition** states:

A pressure injury is localized damage to the skin and underlying soft tissue usually over a bony prominence or related to a medical or other device. The injury can present as intact skin or an open ulcer and may be painful. The injury occurs as a result of intense and/or prolonged pressure or pressure in combination with shear. The tolerance of soft tissue for pressure and shear may also be affected by microclimate, nutrition, perfusion, comorbidities and condition of the soft tissue (NPIAP, 2016a).

(Changes in the staging system will be discussed later in this course.)

The localized damage in pressure injury is the result of compression of soft tissue, which interferes with the tissue’s blood supply, leading to vascular insufficiency, tissue anoxia, and cell death. Pressure injuries can develop within 24 hours of the initial pressure but may take as long as a week to present themselves. The first tissues to die are nearest the bone, and as the pressure and anoxia continue, the remaining layers of tissue begin to die. The skin is the last to die. The damage resembles an iceberg, with a smaller amount of damage visible at the surface and a large amount of damage below the surface.

Pressure injury usually occurs over bony prominences such as the sacrum, ischium, heel, and trochanter, where there is less tissue to compress. Other factors—such as shearing, skin moisture, heat, poor nutrition, comorbidities, and incontinence—also contribute to the tissue breakdown.

**The Impact of Pressure Injury**

Each year about 1.7 million individuals in the United States develop a pressure injury. The overall prevalence of pressure injury can be as high as 17% of the general population (Cowan, 2019). Pressure injury represent a major burden of sickness and reduced quality of life for patients and their caregivers, and the impact of pressure injury is staggering.

- First and foremost, these wounds are very painful, causing patients a great deal of suffering.
- Quality of life is affected, as the patient must alter activities to help heal the wound, and they may face long-term hospitalization.
- The anatomical location of the injury may result in a loss of dignity.
- The burden of dealing with a chronic wound can result in stress, anxiety, depression, less autonomy and security, and impaired social functioning.
- A nonhealing injury is at high risk for infection, which can be life threatening.
- Pressure injury treatment may require surgical procedures such as debridement, colostomies (for those injuries located near the anus), amputations, and grafts or flaps that the patient would otherwise not have to face.
An injury that heals forms scar tissue, which lacks the strength of the original tissue and is more easily reopened again and again.

Pressure injury is a particular problem for bedbound individuals who are hospitalized, in nursing homes, or have spinal cord injuries. Data indicate that around 2.5 million patients in acute-care facilities develop a pressure injury annually (referred to as a hospital-acquired injury), and that 60,000 patients die as a result of the complications of a hospital-acquired injury (HRET, 2017).

In hospitalized patients, pressure injuries are more likely to occur among older adults (65 years and older), and patients with pressure injuries are three times more likely to be discharged to a long-term care facility than those with other diagnoses. Approximately 70% of pressure injuries develop in those over 70 years of age. Pressure injury in older patients who sustain hip fractures is a comparatively frequent occurrence, particularly in fragile elderly patients (WOCN, 2016a; Shah, 2018; Forni, 2018).

Pressure injuries also increase healthcare professionals’ workloads, as additional time and care must be provided to manage and treat patients’ pressure injuries—more dressing changes, more medications, and more documentation.

Healthcare costs due to pressure injury are immense. The cost of care for a full-thickness pressure injury can be as much as $70,000, and the overall financial burden for treatment of pressure injuries in the United States has been estimated at $11 billion yearly (HRET, 2017).

Litigation may be brought against a hospital and its staff for neglect, malpractice, and elder abuse if a patient develops a pressure injury while in the hospital. Awards can be in the millions of dollars. And the bad publicity that follows will damage the hospital’s reputation, bottom line, and the trust patients have that they can be cared for safely.

Pressure injuries are reportable to state and federal agencies. The information is placed in published reports accessible by the public, which then allows the public to compare facility outcomes. Regardless of the care setting (acute, skilled nursing facility, home health, and inpatient rehabilitation facilities), all providers must account for the number of pressure injuries that were present on admission and on subsequent reassessments, whether they have closed or worsened (CMS, 2019a).

Governmental agencies may levy fines against a hospital for pressure injuries. The Centers for Medicare and Medicaid Services no longer pays a hospital for the additional care needed for a patient who develops a hospital-acquired pressure injury, and the hospital must provide the care nonetheless. Similarly, the Affordable Care Act established a financial incentive program for hospitals to improve patient safety by applying a 1% payment reduction to hospitals who score poorly with respect to the occurrence of hospital-acquired conditions, of which pressure injuries are one (CMS, 2019b).

The Agency for Healthcare Research and Quality reported that between 2014–2017 the number of hospital-acquired pressure injuries (HAPI) increased by 6% in the United States. In 2018, the Joint Commission Center for Transforming Healthcare began an initiative to find root causes and
solutions to decrease HAPI. Once completed, the Joint Commission will analyze the findings from the study, with the goal of identifying solutions and interventions that have widespread applicability to all facilities. Once formulated these will be made available to all hospitals (TJC, 2019).

Thus, the assessment, prevention, and treatment of pressure injuries are of major importance to healthcare professionals and to the facilities at which they practice. Most facilities have developed pressure injury prevention programs to put these ideas into practice and prevent negative outcomes for both the patient and the facility.

**2019 EPUAP/NPIAP/PPPIA CLINICAL PRACTICE GUIDELINE**

The 2019 release of *Prevention and Treatment of Pressure Ulcer/Injuries: Clinical Practice Guideline (3rd ed.)* is the outcome of research conducted by the European Pressure Ulcer Advisory Panel, National Pressure Injury Advisory Panel, and Pan Pacific Pressure Injury Alliance. This guideline stipulates 115 evidence-based recommendations as well as practical help to guide healthcare professionals with application of the recommendations in clinical practice.

Each recommendation includes a level of strength (denoted as A, B1, B2, and C) to establish its importance in preventing and treating pressure injuries. For example, limited mobility and limited activity with exposure to shear and friction presents a high risk for pressure injury development and is classified as level A.

The guideline also includes 61 “Good Practice Statements,” which are described as “statements that are not supported by a body of evidence but considered to be significant for clinical practice.” An example of a good practice statement is to be aware of the potential impact of a previous pressure injury on the development of a future pressure injury (EPUAP/NPIAP/PPPIA, 2019).

Recommendations found in the Wound, Ostomy, and Continence Nurses Society’s 2016 *Guideline for Prevention and Management of Pressure Ulcers (Injuries)* remain consistent with the 2019 EPAUP/NPIAP/PPPIA recommendations.

**RISK ASSESSMENT**

The purpose of assessing the risk for developing pressure injuries is to implement early detection and prevention measures. This is of utmost importance, as assessment without intervention is meaningless.
Risk Factors for Pressure Injuries

Certain groups of patients have a higher risk for developing pressure injuries. These include patients who:

- Are older adults (those over age 65 are at high risk and those over age 75 are at even greater risk)
- Are in critical care
- Have a fractured hip (which indicates increased risk for heel pressure injuries)
- Have spinal cord injuries (spasticity, the extent of the paralysis, a younger age at onset, difficulty with practicing good skin care, and a delay in seeking treatment or implementing preventive measures increase the risk of skin breakdown)
- Have diabetes, secondary to complications from peripheral neuropathy
- Are confined to a wheelchair or bed
- Are immobile or for whom moving requires significant or taxing effort (i.e., morbidly obese)
- Experience incontinence
- Have neuromuscular and progressive neurological diseases (e.g., multiple sclerosis, ALS, Myasthenia gravis, stroke)
- Have neurodegenerative disorders (e.g., Parkinson’s disease, dementia)

Changes in both skin structure and function due to aging contribute to the occurrence of skin problems and decrease wound healing.

- A flattening of the epidermal-dermal junction decreases the overall strength of the skin, which increases the risk for skin tears and blistering.
- A decrease in the melanocytes and Langerhans cells increases the risk for allergic reactions and sensitivity to sunlight.
- A decrease in fibroblast function increases the time required to synthesize collagen.
- A decrease in blood flow decreases skin temperature and delays healing.
- A decrease in oil and sweat production contributes to dryness and flaking.
- A decrease in subcutaneous tissue, especially fat, decreases the body’s natural insulation and padding.

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• A decline in the reproduction of the outermost layer of the epidermis may lead to the skin’s inability to absorb topical medications.

These changes in skin structure and function (together with changes in cellular DNA that affect cell reproduction and the ability to protect the skin) and the risks that occur with a change in overall health and functional ability put an aged patient at very high risk for the formation of a pressure injury (WOCN, 2016b; EPUAP/NPIAP/PPPIA, 2019).

More than 100 additional risk factors associated with the development a pressure injury have been identified. Some of these include:

• General medical conditions, such as diabetes, stroke, multiple sclerosis, cognitive impairment, cardiopulmonary disease, cancer, hemodynamic instability (abnormal/unstable blood pressure), peripheral vascular disease, malnutrition, and dehydration
• Smoking
• History of a previous pressure injury (since scar tissue is weaker than the skin it replaced and will break down more easily than intact skin)
• Increased facility length of stay
• Undergoing surgery longer than four hours
• Significant weight loss
• Prolonged time on a stretcher (since the surface is not conducive to pressure relief)
• Emergency department stays
• Medications, such as sedatives, analgesics, and nonsteroidal anti-inflammatory drugs (NSAIDs)
• Impaired sensation
• Refusal of care, such as when a patient refuses to be turned or moved despite education
• Edema
• Obesity
• Patient not being turned
• An ICU stay, due to the high acuity of illness, presence of multiple comorbid conditions, and:
  o Mechanical ventilation
  o Vasopressors and hemodynamic instability
  o Multiple surgeries
  o Increased length of stay
  o Inability to report discomfort
(WOCN, 2016a; EPUAP/NPIAP/PPPIA, 2019)
Risk Assessment Schedules

The skin is the largest organ in the body, and the clinician must assess it regularly. The assessment of pressure injury risk is performed upon a patient’s entry to a healthcare setting and repeated on a regularly scheduled basis (per facility policy) as well as when there is a significant change in the patient’s condition, such as surgery or a decline in health status (WOCN, 2016a; EPUAP/NPIAP/PPPIA, 2019).

A schedule for reassessing risk is established based on the acuity of the patient and an awareness of when pressure injuries occur in a particular clinical setting. Recommendations based on the healthcare setting are included below (WOCN, 2016a; EPUAP/NPIAP/PPPIA, 2019). A particular facility or setting may have different regulations.

Across all settings the three groups most at risk for pressure injuries are:

- Individuals over 65 years of age
- Neonates and children younger than three
- Individuals of any age with spinal cord injury

ACUTE CARE

Generally, pressure injuries can develop within the first two weeks of hospitalization, and elderly patients can develop pressure injuries within the first week of hospitalization. The initial assessment is conducted upon admission and repeated:

- At least every 24 to 48 hours
- Whenever the patient is transferred from one unit to another
- Whenever the patient’s condition changes or deteriorates
- Per facility policy

Most medical-surgical units reassess daily.

ICU/Critical Care

ICU patients are at high risk for developing pressure injuries, especially on the heel. ICU patients have been shown to develop pressure injuries within 72 hours of admission. Pressure injuries have been associated with a two- to fourfold increase in the risk of death in older people in the ICU. Pressure injury assessment is to be done at least once every 24 hours (WOCN, 2016b; EPUAP/NPIAP/PPPIA, 2019).

One study of 84 ICU patients found that over 30 days, 33 patients developed pressure injuries and seven of the pressure injuries were medical device–related. Another study demonstrated that mean arterial pressure and positive end-expiratory pressure in ICU patients on a mechanical ventilator can be contributing factors to the risk of developing pressure injury. The importance of
carefully monitoring hemodynamic parameters in ICU patients, particularly mean arterial pressure, and carefully deciding on the most appropriate positive end-expiratory pressure for these patients was emphasized as a mechanism to decrease the occurrence of pressure injuries (Soodmand, 2019).

**INPATIENT REHABILITATION SETTINGS**

Studies in this area showed that 1.4% of patients developed a new or worsening pressure injury during their stay. The presence of a pressure injury was significantly associated with lower gains in motor function, longer length of stay, and decreased odds of being discharged to the community. Assessment is on admission and per facility protocol.

**LONG-TERM CARE**

In long-term care settings, most pressure injuries develop within the first four weeks.

- In skilled nursing facilities, the initial assessment is conducted upon admission and repeated weekly thereafter.
- In nursing homes with long-term patients, the assessment is conducted upon admission, repeated weekly for the first month, and repeated monthly thereafter, or whenever the patient’s condition changes.

**HOME HEALTH**

In home healthcare settings, most pressure injuries develop within the first four weeks.

The initial assessment is conducted upon admission and repeated:

- At resumption of care
- Recertification (assessment and approval of the need for continuation of patient care)
- Transfer or discharge
- Whenever the patient’s condition changes

Some agencies reassess with each nursing visit.

**HOSPICE AND PALLIATIVE CARE**

One study showed that of eight pressure injuries that developed during the study, five occurred within two weeks prior to death. Assessment occurs at admission and as patient condition changes.
Elements of an Assessment

Prevention of pressure injuries must begin with frequent and routine assessment of the patient’s skin and of the risk factors that, if left unmanaged, will contribute to the development of an injury. Risk assessment without interventions to modify the risk is meaningless.

A head-to-toe inspection of the skin must be done on admission and at least daily (or per facility regulation). Five parameters for skin assessment are recommended by the Centers for Medicare and Medicaid Services, including skin color, skin temperature, skin texture/turgor, skin integrity, and moisture status (WOCN, 2016a). The assessment should focus on high-risk areas such as bony prominences, areas of redness, and under medical devices. The specific areas to assess are shown in the table and diagram below.

### ASSESSING A PATIENT’S SKIN

<table>
<thead>
<tr>
<th>If the patient’s position is:</th>
<th>Then focus on these areas:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lateral</td>
<td>Ear, shoulder, trochanter, knee, ankle</td>
</tr>
<tr>
<td>Supine</td>
<td>Occiput, shoulder blades, elbows, sacrum, heels, toes</td>
</tr>
<tr>
<td>Semi-recumbent</td>
<td>Occiput, shoulder blades, elbows, sacrum, ischial tuberosities, heels</td>
</tr>
<tr>
<td>Seated</td>
<td>Shoulder blades, spinal protrusions, elbows, sacrum, ischial tuberosities, heels</td>
</tr>
</tbody>
</table>

Bony prominences are high-risk areas for pressure injuries.
(Source: © Invacare Corporation. Used with permission.)

Blanchable erythema is a reddened area that temporarily turns white or pale when pressure is applied with a fingertip. This is an early indication to redistribute pressure. Nonblanchable erythema is redness that persists when fingertip pressure is applied. It means that tissue damage
has already occurred. (See “Stage 1 Pressure Injury” later in this course for images of blanchable and nonblanchable erythema.)

It can be difficult to identify skin problems in patients with dark skin. Redness may not be easy to see. The clinician needs to compare the at-risk area (such as the coccyx or hip) with skin next to it and look for color differences or changes in temperature or pain.

ASSESSMENT AND MEDICAL DEVICES

Medical devices such as shoes, heel and elbow protectors, splints, oxygen tubing, face masks, endotracheal tube holders, compression stockings and TED hose, and others must be removed and the skin inspected daily. For example, oxygen tubing can cause pressure injuries on the ears, and compression stockings and TED hose have been known to cause heel injuries.

If the device cannot be removed—such as a nasogastric (NG) tube, urinary catheter, tracheostomy holder, neck brace, or cast—then the skin around the device must be carefully inspected: the nares for an NG tube, the neck for a tracheostomy, the mucosa for a urinary catheter, etc. If the patient complains of pain under an unremovable device, notify the physician.

**Consider all adults with medical devices to be at risk for pressure injuries.**

- The Joint Commission’s Quick Safety issue on the management of medical device–related pressure injuries (MDRPI) states that almost every hospital patient needs at least the use of one medical device during their stay, which puts them at risk for pressure injury (Camacho-Del Rio, 2018).

- Between 50%–90% of pressure injuries in the pediatric population are MDRPIs. In the pediatric population, MDRPIs include injuries caused by central lines, endotracheal tubes, feeding tubes, pulse oximetry monitors, tracheostomy appliances, and respiratory equipment. Studies indicate the majority of MDPRIs result from the use of respiratory equipment (Boyar, 2019a).

- A recent international study of MDPRIs in adult patients found that the most common sites are the ears and feet. Over 30% of MDPRIs were associated with nasal oxygen tubing, with injury to the ears and nose (Kayser, 2018).

Injuries caused by medical devices are reportable to state and federal agencies, just as are those caused by pressure on bony prominences (EPUAP/NPIAP/PPPIA, 2019).

ASSESSMENT AND MOBILITY

**Immobility is the most significant risk factor for pressure injury development.** More frequent monitoring to prevent pressure injuries is conducted for patients who have some degree of immobility, including those who are:
• Nonambulatory
• Confined to bed, chairs, wheelchairs, recliners, or couches for long periods of time
• Paralyzed and/or have contractures
• Wearing orthopedic devices that limit function and range of motion
• Dependent on assistance to ambulate or reposition themselves

ASSESSMENT FOR FRICTION VS. SHEARING

Friction is the rubbing of one surface against another. Patients who cannot lift themselves during repositioning and transferring are at high risk for friction injuries. Friction may contribute to the development or worsening of a pressure injury due to the shear it creates. There are two types of friction:

• **Static** friction is the force that resists motion when there is no sliding; for example, static friction prevents an individual from sliding down in bed when the head of the bed is elevated.

• **Dynamic** friction is the force between two surfaces when there is sliding, for example, when a person is sliding down in bed. Skin trauma can result.

Shear is the mechanical force that is parallel to the skin and can damage deep tissues such as muscle. Shear can result when friction stretches the top layers of skin as it slides against a surface, or deeper layers when tissues attached to the bone are pulled in one direction while the surface tissues remain stationary.

Shearing most commonly occurs when the head of the bed is elevated above 30 degrees and the patient slides downward. Friction is most common when patients are turned or pulled up in bed (WOCN, 2016a; EPUAP/NPIAP/PPPIA, 2019).

ASSESSMENT FOR INCONTINENCE

Moisture from incontinence can contribute to pressure injury development by macerating the skin and increasing friction injuries. Fecal incontinence is an even greater risk for pressure injury development than urinary incontinence because the stool contains bacteria and enzymes that are caustic to the skin. When both urinary and fecal incontinence occur, the fecal enzymes convert the urea in the urine to ammonia, which raises the skin’s pH. When the skin pH is elevated (alkaline), the skin is more susceptible to damage. Pressure injuries are four times more likely to develop in patients who are incontinent than in those who are continent (WOCN, 2016a).

ASSESSMENT FOR NUTRITIONAL STATUS

Although individual nutrients and their specific roles in preventing pressure injury have not been determined, malnutrition is associated with overall morbidity and mortality. A nutritional
assessment should be conducted upon admission or when there is a change in the patient’s condition that would increase the risk of malnutrition, such as:

- Patient’s refusal to eat or eating less than usual
- Prolonged NPO status
- Development of a wound or other conditions that increase metabolic demand
- When a pressure injury is not progressing toward healing

The clinician must also keep in mind that overweight and obese patients can be malnourished and should undergo a nutritional assessment.

**Parameters to assess** include:

- Current and usual weight
- History of unintentional weight loss or gain
- Food intake
- Dental health
- Ability to swallow and/or feed oneself
- Medical interventions (such as surgeries of the gastrointestinal tract that may affect absorption of nutrients such as vitamin B₁₂)
- Psychosocial factors (such as the ability to obtain and pay for food)
- Cultural influences on food selection

Serum albumin and prealbumin are no longer considered reliable indicators of nutritional status, as there are multiple factors that will decrease albumin levels even with adequate protein intake. These include inflammation, stress, surgery, hydration, insulin, and renal function. Therefore, laboratory evaluation should be only one part of a nutrition assessment (WOCN, 2016a; Bryant & Nix, 2016; Shah, 2018).

**CASE**

Mr. Frank is a 90-year-old man who has been admitted to the hospital with pneumonia. He fell at home three months ago and was also hospitalized at that time. His equally elderly wife denies that she is having any difficulty caring for him and says that he eats well and takes all his medications.

The admitting nurse finds Mr. Frank to be very thin and that he weighs 10 pounds less than when he was hospitalized after his fall. His incontinence brief is saturated with urine, and his perineal skin is raw. He does not move himself in the bed. The nurse recognizes that Mr. Frank is at high risk for developing a pressure injury due to his poor nutrition, his immobility, and his incontinence. The nurse discusses with the physician the patient’s need for a dietitian referral, a pressure reduction mattress, and a barrier product to protect his skin. She alerts the
discharge planner that Mr. Frank may also require home health, with personal care services daily if that is available with his insurance coverage.

The physician also requests a physical therapy (PT) and occupational therapy (OT) evaluation and recommendations to improve the patient’s mobility and self-care needs in order to reduce his risk for developing a pressure injury. Prior to discharge, a physical therapist and occupational therapist assess and work with Mr. Frank, as well as providing pertinent education and hands-on training for Mrs. Frank in order to optimize her ability to safely care for her husband at home.

For instance, the physical therapist begins to teach Mrs. Frank how to safely assist her husband with bed mobility, transfers to/from a bedside chair and/or commode, and ambulating short distances with a rolling walker. The occupational therapist teaches Mrs. Frank how to safely assist her husband with ADLs (such as dressing, bathing, and toileting). Both therapists recommend continued PT and OT services in the home setting in order to progress the patient’s functional mobility and independence with ADLs.

If Mr. Frank and his wife continue to have difficulty with his care at home, nursing home placement will need to be considered.

Determining Risk Levels

Several risk assessment tools or scales are available to help predict the risk of a pressure injury, based primarily on those assessments mentioned above. These tools consist of several categories, with scores that when added together determine the total risk score.

The Braden Scale for Predicting Pressure Sore Risk is the most popular, widely used risk assessment tool in use today for predicting pressure injuries. It was first published in 1987 and has thus been in use for about 30 years across a variety of settings. Two other common scales are the Norton Scale and the Waterloo Scale (WOCN, 2016d). The clinician uses these tools to help determine risk so that interventions can be started promptly.

These tools are only used for assessing adults. The Braden-Q Scale has subcategories that relate to assessing children.

It is important that when the clinician uses a scale, the scale must not be altered in any way, meaning there cannot be shortcuts or changes to the definitions. Any changes would alter the accuracy and usefulness of the scale in predicting the risk of developing pressure injuries. The same scale should be used consistently throughout the facility, and if this is not a standard practice, it is one that clinicians should advocate for.

Assessment tools notwithstanding, if a patient has other major risk factors present (such as age, fever, poor perfusion, etc.), the patient may be at higher risk than a risk score would indicate. Clinicians should work to assure that, regardless of the specific risk assessment tool being used, the professionals using it are proficient in its use and knowledgeable regarding potential risk
factors within their patient population that are not accounted for in the assessment tool they are using (WOCN, 2016b).

**BRADEN SCALE**

The Braden Scale consists of six categories:

1. Sensory perception: Can the patient respond to pressure-related discomfort?
2. Moisture: What is the patient’s degree of exposure to incontinence, sweat, and drainage?
3. Activity: What is the patient’s degree of physical activity?
4. Mobility: Is the patient able to change and control body position?
5. Nutrition: How much does the patient eat?
6. Friction/shear: How much sliding/dragging does the patient undergo?

There are four subcategories in each of the first five categories and three subcategories in the last category. The scores in each of the subcategories are added together to calculate a total score, which ranges from 6 to 23. The higher the patient’s score, the lower their risk.

- Less than mild risk: ≥19
- Mild risk: 15–18
- Moderate risk: 13–14
- High risk: 10–12
- Very high risk: ≤9

It is recommended that if other risk factors are present (such as age, fever, poor protein intake, hemodynamic instability), the risk level be advanced to the next level. Each deficit that is found when using the tool should be individually addressed, even if the total score is above 18. The best care occurs when the scale is used in conjunction with nursing judgment. Some patients will have high scores and still have risk factors that must be addressed, whereas others with low scores may be reasonably expected to recover so rapidly that those factors need not be addressed (WOCN, 2016b).

(See also “Resources” at the end of this course.)

**NORTON SCALE**

The very first pressure injury risk evaluation scale, called the Norton Scale, was created in 1962 and is still in use today in some facilities. It consists of five categories:

1. Physical condition
2. Mental condition
3. Activity
4. Mobility
5. Incontinence

Each category is rated from 1 to 4, with a possible total score ranging from 5 to 20. A score of less than 14 indicates a high risk of pressure injury development.

WATERLOO SCALE

The Waterloo Scale, mainly used in Europe, was developed in 1987. This scale consists of seven items:

1. Weight for height
2. Skin type
3. Sex and age
4. Malnutrition screening tool
5. Continence
6. Mobility
7. Special risk factors

Potential scores range from 1 to 64. The tool identifies three categories of risk: at risk (score of 10–14), high risk (score of 15–19), very high risk (score of 20 and above).

Of the three tools described above, the Braden Scale is the most validated pressure injury risk assessment tool, and it is the most widely used assessment tool in the United States (Shah, 2018; Baranoski & Ayello, 2016). In a study comparing the Braden and Waterloo tools, it was found that the Braden Scale took less time to administer and addressed risk factors that are more objective. Data from the study put the reliability of the Braden Scale at 83% and that of the Waterloo Scale at 40% (Solati, 2016).

THERMAL IMAGING TO DETECT DEEP TISSUE INJURY

Research has shown that changes in temperature frequently occur before there are changes in skin color. Thermal imaging has therefore become an established tool in the assessment of deep tissue pressure injury (DTPI). Human skin produces infrared radiation, which allows long-wave infrared thermography (thermal imaging) to detect changes in skin temperature. It has been found that alterations in skin color related to unrelieved pressure more often develop into a pressure injury when the temperature of the area at baseline is below that of the adjacent skin.

In a study of 114 patients in an ICU, thermal imaging was used along with clinical assessment to evaluate anatomical sites at high risk for DTPIs, namely, the coccyx, sacrum, and bilateral heels. Thermal assessments were performed using the Scout Device, which is FDA approved for this...
procedure. Detecting early changes in skin temperature before there were any visible signs of DTPI allowed for proactive interventions, and data from the study demonstrated about a 60% reduction in the number of DTPIs compared to the unit’s usual rate.

Study authors pointed out that thermal imaging can result in significant cost savings, reduced expenditure in treating pressure injury, and reduced settlements related to legal liability for hospital-acquired pressure injury. Clinicians require training in the correct use of thermal injury equipment (Koerner, 2019).

PRESSURE INJURY PREVENTION

It is more cost efficient to prevent a pressure injury than to cure one. Interventions that will help the clinician prevent pressure injuries include:

- Minimizing pressure through regular repositioning
- Using a support surface for body weight distribution
- Managing incontinence to prevent skin damage from moisture
- Managing nutrition and hydration to support the body in preventing damage and healing any damage that has occurred

(Baranoski & Ayello, 2016; EPUAP/NPIAP/PPPIA, 2019)

Regular Repositioning and Early Mobilization

While the underlying cause and formation of pressure injuries is multifaceted, by definition a pressure injury cannot form without pressure on the tissue. Thus, immobility is the most significant risk for the development of pressure injuries. High pressures over bony prominences for a short time and low pressures over bony prominences for a long time are equally damaging (Baranoski & Ayello, 2016). In order to decrease the risk, it is important to reduce the time and amount of pressure the patient is exposed to.

All patients must have their positions changed on a regular schedule. How often this is done is determined by each patient’s activity/mobility level, tissue tolerance, skin condition, overall medical condition, treatment goals, type of pressure redistribution support surface used, and the comfort of the patient (Shah, 2018).

Physical therapists may be involved in all aspects of pressure injury prevention, including the initial patient assessment, evaluation of patient mobility, and recommendation and implementation of treatments. An occupational therapist can also provide interventions for transfers, skill training for mobility, and independence skills for hygiene and toileting. Skills learned from these therapists can reduce incontinence and immobility, which can reduce the risk of pressure injury development (Bryant & Nix, 2016).
INTERDISCIPLINARY APPROACH
Improving the mobility of patients, or mitigating the effects of immobility, requires the assistance of many in the healthcare team:

- **Bedside clinicians**: Assess for all risk factors, see that needed interventions are provided, and reassess outcomes frequently.

- **Physical therapists**: Evaluate functional mobility and/or provide wound evaluation/treatment for patients with potential or actual pressure injury. May provide interventions including direct wound care, optimization/maintenance of joint range of motion, strength training, seating and positioning recommendations, evaluation of support surfaces, functional mobility and/or balance training, gait training, and/or assistive device recommendations/training.

- **Occupational therapists**: Address lifestyle factors that can lead to increased incidence of pressure injuries, including assessing the patient’s cognitive and functional capacity and recommending adaptive equipment and interventions to meet individual patient needs.

- **Medical equipment department**: Determine what equipment is available for the patient.

- **Social workers**: Uncover what resources are available to the patient.

(Bryant & Nix, 2016)

BED-BOUND PATIENTS
For bed-bound patients, the standard “turn every two hours” may be more than adequate for some but not at all adequate for others. Evidence suggests that turning/repositioning every four hours, when combined with a pressure-redistributing mattress, is as effective for prevention of pressure injury as repositioning or turning every two hours (WOCN, 2016a).

It is important to keep in mind that when lateral rotation mattresses are used for pulmonary and cardiovascular care, such rotation does not off-load the skin; the patient must still be repositioned off the bed surface and the skin checked frequently. Lateral rotation is a characteristic of specialized mattresses that rotate a patient around a longitudinal axis in a recurring sequence. Lateral rotation places the patient in positions that maintain one lung higher than the other. The goal of lateral rotation is to prevent pneumonia, not to treat or prevent pressure injury (Baranoski & Ayello, 2016).

If the medical condition is so severe that repositioning the patient regularly is not possible, then a support surface designed to decrease pressure must be used and the patient repositioned with frequent small shifts (e.g., mini or low-angle turns, elevating heels off the bed, repositioning the head and extremities every hour, and passive range of motion). (See also “Using Support Surfaces” below.)
When turning the patient, clinicians often think that the patient must be completely over on a side. This can be difficult for the clinician/caregiver to do, is uncomfortable for the patient, can result in cardio-pulmonary compromise, and actually increases pressure on the side of the body.

Instead, frequent small position changes, rather than completely turning the patient, is faster, easier, and safer for all. Any change in position is beneficial. The patient need only be tilted to the side, no more than 30 degrees, with pillows or wedges to help support and reduce the pressure over bony prominences. A small pillow behind the shoulder or the hip alters position without having to move the entire body. Bending the knee alters the pressure on the sacrum and hip. A pillow between the knees prevents pressure when one bony prominence is lying directly on top of another. A small pillow behind the heel will elevate the heel off the surface and prevent pressure.

NPIAP provides the following general recommendations for repositioning patients in bed:

- Reposition the patient in such a way that pressure is relieved or redistributed.
- Avoid positioning the patient on bony prominences with existing nonblanchable erythema.
- Avoid subjecting the skin to pressure and shear forces and use manual handling aids to reduce friction and shear. Lift—do not drag—the patient while repositioning. Dragging the patient will cause skin damage due to friction. In most situations, simple devices like lift sheets can be used.
- Use a split-leg sling mechanical lift device when available to transfer a patient into a wheelchair or bedside chair when the patient needs total assistance to transfer. A split-leg sling incorporates wide straps that circle the legs. This device allows for comfortable
positioning of the patient and has the added advantage of the patient’s knees not being pushed together, which is the typical position in a hammock sling (Preferred Health Choice, 2019).

- Do not leave moving and handling equipment under the patient after use unless the equipment is specifically designed for that purpose.
- Avoid positioning directly onto medical devices such as tubes, drainage systems, or other foreign objects.
- Do not leave the patient on a bedpan longer than necessary.
- Use principles of safe patient handling to prevent injury to both the patient and the staff.

Additional recommendations for repositioning in bed include:

- Use the 30-degree tilted side-lying position, alternating between right side, back, left side, or prone position if patient can tolerate this and the medical condition allows.
- Encourage individuals who can reposition themselves to sleep in a 30- to 40-degree side-lying position or flat in bed if not contraindicated.
- Avoid lying postures that increase pressure, such as a 90-degree side-lying position or the semi-recumbent position.
- Limit head-of-bed elevation to 30 degrees for an individual on bedrest unless contraindicated by medical condition or feeding considerations. If not contraindicated, lower the head of the bed one hour after eating or intermittent bolus tube feedings (Bryant & Nix, 2016).
- If sitting in bed is necessary, avoid head-of-bed elevation or a slouched position that places pressure and shear on the sacrum and coccyx.

For a patient with an existing pressure injury:

- Do not position the patient directly on the injury or on areas of nonblanchable redness or deep tissue injury; pressure reduces perfusion to the injured tissues and will delay healing and may cause deterioration of the wound.
- Continue to turn and reposition the patient regardless of the support surface in use.
- Inspect the skin for additional damage each time the patient is turned or repositioned.

**PREVENTING HEEL PRESSURE INJURIES**

The reduction of pressure and shear at the heels is very important in clinical practice. Studies indicate the heels are the most common place for the occurrence of deep tissue pressure injury (DTPI), and they are the second most common sites for the occurrence of all pressure injury...
The posterior heel sustains intense pressure even when a pressure reduction surface is used. Because the heel has so little tissue, the pressure is transmitted directly to the bone.

Ideally, heels should be free of all pressure, sometimes called “floating” the heels. Pressure can be relieved by elevating the lower leg and calf from the mattress by placing a pillow under the lower leg or using a suspension device that floats the heel. The pressure will then be spread to the lower leg, relieving the heel. The recommended position for the pillow is lengthwise under the calf, with the heel suspended off the pillow. The patient must still be turned at regular intervals to promote pulmonary, renal, and vascular function along with protecting skin integrity.

Padding devices such as synthetic sheep skin, fleece-lined “bunny boots,” and rigid splints protect the heels and remove friction and shear but do not remove the pressure, and regular skin checks are still required. Common devices such as intravenous bags, rolled towels or sheets, cut-out rings, and water-filled gloves are not designed to redistribute pressure and can actually increase pressure.

In a small study that examined the effectiveness of several heel pressure–relieving devices, it was found that the egg-crate boot and laminated foam boot were the most effective in preventing pressure injuries.

All appropriate heel pressure–relieving devices should be used in conjunction with good nursing care, including frequent, individualized heel inspections. Patients must be reminded to promptly report any heel discomfort, and this should be followed by an immediate assessment by the clinician (Baranoski & Ayello, 2016; EPUAP/NPIAP/PPPIA, 2019).

**CHAIR-BOUND PATIENTS**

A chair-bound patient must be repositioned as well. When a patient is seated, the weight of the body causes the greatest amount of pressure to occur over the ischial tuberosities. Since this area of the body is relatively small, the ischia bear intense pressure when a person is seated; without pressure relief, a pressure injury will occur quickly. If the patient cannot sit upright but slouches in the chair, then the sacral area is at risk as well. Pressure remains unrelieved in a paralyzed
person because the small, involuntary movements that restore blood flow to the tissues are absent.

Specialized wheelchairs that offer a tilt and/or recline option may be indicated for positioning patients at risk of developing pressure injuries. **Tilt** and **recline**, though often confused, actually serve distinct and complementary positioning roles. Reclining a chair changes the hip angle and provides some pressure relief, but shearing forces may remain on the back. A tilt-in-space chair both tilts the head back and raises the feet up concurrently, thereby providing more pressure relief and less shearing forces.

Research has found that wheelchairs with tilt-in-space and recline mechanisms positively decrease sitting interface pressure and increase ischial blood flow. The bulk of the patient is moved from the seat of the wheelchair and is supported by the backrest. The degree to which this happens is proportionate to the tilt-and-recline angle of the wheelchair. Data suggest that even a small amount of tilt-and-recline angle can result in pressure relief to the tissues. However, meaningful increases in ischial blood flow were found only at greater angles of tilt-and-recline. At this time, there is no clear agreement on the period of time that tilt-and-recline should be done in order to effectively prevent pressure injury (Zemp et al., 2019).

**General recommendations** for the chair-bound patient include:

- Stand the patient and reseat them in the chair frequently, if possible.
- Provide adequate seat tilt to prevent sliding forward in the chair and adjust footrests and armrests to maintain proper posture and pressure redistribution.
- Elevate the legs or place the feet on a stool if the feet do not reach the floor in such a way as to slightly tilt the pelvis forward by positioning the thighs slightly lower than horizontally. This will prevent sliding forward out of the chair and reduce pressure on the sacrum.
- Elevate the feet and recline the chair by 30 degrees to reduce pressure.
- If the patient can change their own position, encourage pressure relief every 15 minutes. This includes chair pushups, leaning forward, leaning side to side, or tilting backwards. Leaning forward is the most effective and might be easier than chair push-ups.
- Acutely ill patients at risk for pressure injuries should not sit for longer than two hours at a time and not return to sitting for at least an hour.
- Patients who are incapable of changing their position while sitting should be repositioned at least every hour by a caregiver. (EPUAP/NPIAP/PPPIA, 2019)
For a patient with an **existing pressure injury**:

- Minimize sitting time and consult a seating specialist if the injury worsens on the seating surface selected.
- Consider periods of bed rest to promote ischial and sacral pressure injury healing.
- Avoid sitting a patient with an ischial pressure injury in a fully erect posture.
- Patients with existing pressure injuries on the ischial areas should limit time sitting up in the chair to three times a day for 60 minutes or less, and they must use a cushion (gel or air cushions are best) that redistributes pressure.
  (Bryant & Nix, 2016)

**PHYSICAL AND OCCUPATIONAL THERAPY AND WHEELCHAIR POSITIONING**

Physical and occupational therapists are of great importance in assessing and managing the immobile patient’s activities and instructing staff, patients, and families in proper techniques to prevent pressure injuries. This may include assessing the seating and positioning needs of individuals who are wheelchair bound. Proper wheelchair positioning with an individualized seating system can promote good posture, enhance breathing and digestion, prevent complications such as pressure injuries and skin irritation, slow further loss of mobility, minimize pain, and maximize functioning.

Components of a wheelchair seating system include appropriate size and width as well as specialized supportive cushions, backrests, headrests, and trunk, arm, and leg supports when indicated. The depth of the wheelchair, measured from back to front, must be adequate to provide support from the buttocks to the back of the knees. The floor-to-seat height, measured from floor to seating surface, must be sufficient to keep the patient’s thighs in a position parallel to the floor, with hip flexion as close to 90 degrees as possible (WOCN, 2016b).

**PATIENTS WHO ARE UNABLE TO MAINTAIN REPOSITIONING**

Some patients are unable to maintain position changes, such as patients with dementia or delirium. Since delirium diminishes a patient’s ability to recognize pressure and discomfort, it is recognized as a potential risk factor for pressure injury development. Approximately 5% of older individuals have some form of dementia (Eliopoulos, 2018). Delirium has been found to affect up to 56% of hospitalized older adults depending on the healthcare setting and pre-existing conditions (WOCN, 2016b).

Since delirium is reversible, every effort must be made to find the underlying cause, the most prevalent being:

- Pre-existing dementia
- Postoperative delirium
Each patient will have different risk factors for pressure injury, and each plan of care must be individualized. Pressure injury prevention for confused patients requires a holistic approach. Interventions include:

- Assessing whether the patient’s position looks comfortable:
  - Is the patient’s shoulder jammed against the bed?
  - Is the side-lying position more than 30 degrees?
  - Is the sheet under the patient wrinkle-free and free from debris such as crumbs?
- Placing the patient in a quiet environment
- Minimizing bright lights
- Controlling the temperature
- Promoting rest and comfort (e.g., is the patient hungry, thirsty, in pain, or in need of toileting?)

Patients who refuse care

Some patients may refuse care, refuse to be repositioned, refuse to use a pressure-relieving cushion in their chair, or refuse to participate in PT or OT. The first and most important action by the clinician is communication: Why is the patient refusing care?

- Is it related to their diagnosis, i.e., a traumatic injury such as a spinal cord injury, a chronic condition such as rheumatoid arthritis, or a condition with an uncertain progression, such as multiple sclerosis?
- Is the patient exhibiting signs and symptoms of depression, such as irritability, fatigue, or hopelessness?
- Is a referral to a mental healthcare professional needed?

Open, honest communication with the patient, and if appropriate their caretakers, should address the importance of pressure injury prevention and the consequences of not implementing recommended interventions. When discussing potential complications of refusing care, clinicians must be candid and accurate in their descriptions of the complications so that the patient is left in no doubt about the seriousness of the decision they are making in refusing care and to protect the facility and clinicians against liability and future legal action.
Full, accurate, and objective documentation in the patient’s record is essential. The medical record must show:

- Education provided to the patient
- Frequency of patient education
- Consistent approach among clinicians
- Other interventions, such as involvement of the facility’s ethical committee (Yankowsky, 2017)

It is the patient’s right to refuse care, but clinicians must ensure that facility policies and procedures are followed and that the patient is afforded every option to receive care.

**Strategies** clinicians can employ when treating patients who refuse care include:

- Empathize with the patient. Allow them to verbalize their feelings about their injury or condition. Remember that a loss of control in one’s life is frightening to everyone. Be a good listener.
- Avoid dictating and assuming control. Rather than telling the patient you are going to reposition them, ask them if they would be more comfortable if you helped them to change position.
- Look for the root cause of why the patient is refusing care. Remember that in the majority of cases there is a reason why the patient is not compliant with care.
- Ask the patient if there is anyone they would like to talk to, such as a close friend, a spiritual advisor, or someone who has had a similar traumatic injury.
- As a clinician, do not take the patient’s refusal of care personally. Do not allow personal emotions to interfere with patient interactions.
- Aim for small steps. If the patient will agree to a pressure-relieving cushion in a chair, it is a step in the right direction.
- Continue to educate the patient about why pressure relief is important.
- Remember that the patient is the primary member in the care team and continue to elicit their input on care.
- Remain friendly and caring in word and action; it is a known fact that patients cooperate more readily with clinicians they like. (Collins, 2017)
CASE

Patricia is a 61-year-old female with multiple sclerosis, leaving her bedridden and unable to move her legs. Despite being on a pressure reduction surface, she has developed a stage 3 pressure injury at her sacrum because of refusing to be turned due to the severe pain she experiences from muscle spasms that are triggered each time her right leg is moved. This has made it very difficult for the staff to provide wound care and keep Patricia clean. Furthermore, pain medication has not been effective for Patricia’s very intense but brief episodes of pain.

The nurse asks the physical therapist for recommendations to make moving Patricia less painful for her and less stressful for the staff. After evaluating Patricia, the therapist recommends daily PT treatment, including localized heat treatments to her right leg and gentle active-assisted range of motion to her trunk and extremities prior to attempting bed mobility. PT sessions also focus on improving Patricia’s independence with functional bed mobility (as tolerated).

After several treatment sessions, Patricia is able to tolerate and actively assist with turning toward her right side and staying in position for the time needed to care for her wound and clean her. The therapist also instructs the staff about less painful ways to assist Patricia with bed mobility and positioning to allow wound care, in order to minimize discomfort to her lower extremities. As a result, Patricia is able to tolerate and even actively assist in turning from side to side, and her leg pain when repositioned is reduced to a more tolerable level.

Using Support Surfaces

Factors in the development of pressure injuries include prolonged pressure, friction/shear, and moist, warm skin. Each of these factors can be at least partially controlled by an appropriate surface for the bed and/or chair. A support surface is a specialized mattress or mattress overlay, chair cushion, or stretcher/operating room pad designed for the management of pressure loads and microclimate. (Microclimate is the term used to describe the local tissue temperature and moisture at the body/support interface, and microclimate control is a function of some support surfaces.) (See also “Emerging Therapies” later in this course.)

Pressure redistribution is the most important feature of a support surface. The body’s tissues can withstand higher loads of pressure for short periods of time and lower loads for longer periods of time. A surface that effectively redistributes pressure across the entire body (contact) surface effectively reduces the amount of pressure and extends the time a patient can safely remain in one position (WOCN, 2016b; EPUAP/NPIAP/PPPIA, 2019).

It is critical to remember, however, that there is no mattress, cushion, or bed available today, at any price, that will eliminate pressure and relieve the clinician or caregiver from having to reposition the patient. Patients must still be repositioned no matter what surface is used. Likewise, pressure is not the only contributing factor to skin breakdown and does not replace attention to perfusion, nutritional support, and management of comorbidities (WOCN, 2016b).
IMMERSION, ENVELOPMENT, AND BOTTOMING OUT

In order to redistribute pressure, a support surface must conform to the contours of the body through immersion and envelopment. Immersion is the depth to which the body “sinks into” the surface. As the body does this, the pressure is spread out along the body surface. Immersion is dependent on the stiffness and thickness of the support surface and the flexibility of its cover.

Envelopment is the ability of the support surface to conform to irregularities such as clothing, bedding, and bony prominences without causing substantial increase in pressure. This maximizes pressure redistribution.

In contrast to the functions of immersion and envelopment, the term bottoming out is used to indicate excessive penetration of the surface, meaning the body sinks so deeply into the surface that its bony prominences are actually resting on the underlying bed frame. Factors that contribute to bottoming out include:

- Patient weight that exceeds the support surface’s limits
- A disproportion between weight and size, such as in a patient with bilateral leg amputations, which results in more of the body weight being concentrated in the trunk
- Consistently keeping the head of the bed over 30 degrees
- Inadequate support settings such as under- or overinflation

For some support surfaces, bottoming out can be evaluated by placing one’s hand palm-up beneath the support surface in the area underlying the patient’s bony prominence. If the patient’s bony prominence can be felt by the hand, then the support surface is not supporting the patient properly. However, many support surfaces cannot be assessed this way; the clinician must contact the equipment department of the facility or the supplier or manufacturer of the support surface for information on how to assess the functioning of the support surface.

COMPONENTS OF A SUPPORT SURFACE

The most important component of a support surface is the medium used to provide the pressure redistribution. This can be air, fluid, or solid, alone or in combination.

Foam is a solid material and is available in all configurations. Foam surfaces are generally low-cost and lightweight and require minimal maintenance. Disadvantages include the fact that foam does not last long since it compresses over time; it absorbs moisture (which can be a potential for infection); and it is hard to dispose of. Closed-cell foam does not allow air through, which can increase skin temperature, while open-cell foam does allow air to enter and exit, making it more conformable to the body. One type of open-cell foam is memory foam. If a foam pad is used on top of a mattress (known as an overlay) to redistribute pressure, it needs to be at least three inches thick.
Gel pads contain a mix of substances that allow them to respond like memory foam. They are good at preventing shear, but they can result in increased skin moisture.

Fluid support surfaces include a viscous substance that is thick but free-flowing, which allows it to redistribute weight. Water-filled surfaces reduce pressure better than a standard mattress but are undesirable for use in a hospital due to multiple concerns, such as temperature control, leakage, difficulty with transfers, performance of CPR, and the time and labor involved in draining the mattress and moving the bed.

Air is frequently used in support surfaces; however air-filled surfaces have the potential to leak if damaged and require either periodic manual reinflation (if nonpowered) or an electric pump to remain inflated. Studies show that low-air-loss surfaces prevent the accumulation of moisture and resultant skin maceration (Baranoski & Ayello, 2016; EPUAP/NPIAP/PPPIA, 2019).

Some support surfaces have low-friction covers (like Gore-Tex) to reduce friction so that the skin slides more easily over the surface without putting strain on the skin that could cause damage. However, even these support surfaces cannot provide total prevention against the shearing that occurs when the patient slides down in bed when the head is raised; other interventions are needed to prevent that (WOCN, 2016b).

CATEGORIES OF SUPPORT SURFACES

Support surfaces are commonly used in a variety of applications:

- Mattresses and mattress overlays
- Operating room bed surfaces
- Examination and procedure table surfaces
- Pads for emergency and transport stretchers or gurneys

General categories of support surfaces include mattresses, overlays, and integrated bed systems. Specific features include cushions and pads. They may be powered or nonpowered, active or reactive. Added features may include low air-loss, air-fluidization, lateral rotation, and alternating pressure (see below).

Rings, foam cutouts, or donuts under the patient should not be used as support surfaces, as these concentrate pressure on surrounding tissue, causing swelling and decreasing circulation. The fact that they can be found in medical supply stores does not mean they are safe to use.

With the use of any support surface, the number of linens and other items used under the patient must be kept at a minimum or the pressure-reducing ability of the surface will be altered significantly. Staff, patients, and family members must be instructed to use no more than two items between the patient and the surface (e.g., one pull sheet and one incontinence pad or product).
**General Categories**

**Mattresses** can be composed of any medium or a combination, and may require a specialized bed frame. They create much less risk of bottoming out and can provide other therapeutic functions such as reduced friction and shear and improved microclimate management between the patient’s skin and the surface.

**Overlays** can be composed of any medium and are placed on top of an existing mattress. They are thinner than mattresses, putting the patient at risk for bottoming out. Other drawbacks are: they elevate the height of the sleep surface, can complicate patient transfers, alter the fit of linens, and increase the risk of falls or entrapments. When a foam overlay is used, it should be a minimum of three inches thick to provide pressure redistribution.

**Integrated bed systems** are comprised of the support surface and bed frame combined into a single unit. Their advantage is that the frame may include many features to make the bed easier and safer to use, such as alarms, scales, and the ability to support more weight.

**Specific Categories**

**Procedure, transport, ER, and OR mattresses** are used for patients who need a support surface in bed, since this means they also need one while on gurneys or tables. Many companies provide pressure redistribution pads for surfaces other than beds.

**Chair cushions** are utilized for patients who sit for a long time in order to reduce the risk for ischial pressure injuries. These cushions must be matched to the patient based on size, posture, mobility, and lifestyle needs, and include covers that can dissipate heat. Some specialized wheelchair cushions may also address incontinence.

**Active surfaces** can be either a powered mattress or an overlay that changes its load distribution whether or not someone is on the surface (called alternating pressure). The air cells in such surfaces cyclically inflate and deflate, which changes the areas of the body under pressure. These are recommended for patients at high risk and for whom frequent manual repositioning is not possible.

**Reactive surfaces** move only in response to the patient’s body. These can be powered or nonpowered (nonpowered also being referred to as static air surfaces). These are low-tech, compact, and low in weight (Edsberg et al., 2016). They are available as chair cushions, overlays, mattresses, and procedure pads. All reactive support surfaces are appropriate for pressure injury prevention in patients who are frequently repositioned. Some are appropriate for patients with existing pressure injuries.

**Low-air-loss surfaces** have a pump that provides a slow, continuous airflow into the mattress for even pressure distribution and continuous airflow across the skin for microclimate management. The amount of pressure in the mattress can be adjusted for the
height and weight of the patient, and the mattress further adjusts when a patient sits up in bed to prevent bottoming out. Controls allow instant deflation for CPR. They cannot be used on patients with unstable spines.

**Air-fluidized surfaces** contain silicone-coated beads that provide both air and fluid support. When air is pumped through the beads, the beads behave like a liquid and the patient floats, with two thirds of the body immersed in the warm, dry beads. When the bed is turned off, it becomes hard enough for repositioning or CPR. Some beds now combine air-fluidized therapy in the lower half of the bed and low air-loss in the upper half, allowing the bed to be adjustable. This is a very expensive therapy and should only be used for patients who require very high-level care, such as those with multiple wounds or flap procedures (a surgical procedure to close a pressure injury). The beds are also extremely heavy and may not be safe in a home.

Lateral rotation is used to prevent and treat certain cardiopulmonary conditions. With this feature, the patient is continually rotated from side to side. While some low-air-loss beds may incorporate lateral rotation, this does not eliminate the need for routine manual repositioning. This is because when the bed turns the patient, the patient’s skin and tissues never leave the surface of the bed, and thus pressure is not relieved (WOCN, 2016b).

**CHOOSING A SURFACE**

A support surface must be selected to will meet the patient’s needs for pressure redistribution based on the following factors:

- Level of immobility and inactivity
- Need for microclimate control and shear reduction
- Size and weight of the patient
- Risk for development of new pressure injuries
- Number, severity, and location of existing pressure injuries
  (Bryant & Nix, 2016; EPUAP/NPIAP/PPPIA, 2019)

Other factors to consider include:

- Fall and entrapment risk (overlays and mattresses can increase the height of the sleep surface)
- In a patient who is a candidate for progressive mobility, a surface that makes it easier to get out of bed
- Compatibility of the surface with the care setting
- Availability of the product
• Previous support surface usage and patient preference

• Achievement of specific outcomes (i.e., prevention of pressure injury)
  (WOCN, 2016b; Bryant & Nix, 2016; EPUAP/NPIAP/PPPIA, 2019)

Determining the appropriate support surface is based first on the patient’s condition and the healthcare setting. Overall, if the patient is able to be turned and has at least two intact turning surfaces, meaning the skin is intact on two sides of the body (e.g., the right and left trochanters), then a mattress overlay or an alternating pressure pad can be used over a regular mattress. If the patient has skin breakdown on more than one side of the body, then a mattress replacement should be used. Depending on the healthcare setting, patients who already have stage 3 or 4 pressure injuries on their trunks qualify for a mattress replacement.

Cost and product availability are secondary considerations in choosing a surface. The healthcare setting will also determine the product used. For instance, in the home setting the weight of the bed, the structure of the home, the width of the doors, and the availability of uninterrupted electrical power will have a major impact on the support surface available for use. A patient’s health insurance may be a significant determining factor as to which surface will be available to the patient.

In general, a standard hospital mattress should not be used with at-risk patients. It is important to contact the medical equipment department to determine what is available for pressure reduction (WOCN, 2016a).

**Patient Size and Weight**

The support surface chosen must be approved for the patient’s body size and weight. Most conventional support surfaces are for patients who weigh 300 pounds or less. If the patient weighs more than this, then a bariatric mattress and frame must be obtained.

Even in patients who weigh less than the weight limit, where their weight is concentrated may make a difference in the mattress needed. The mattress may not be able to support the patient when the body weight is not evenly distributed. For instance, a paralyzed patient or an amputee may weigh under the limit, but most of the weight will be concentrated in the trunk. If it looks as though the patient is lying or sitting in a “well,” the surface may not be able to support the patient’s weight.

In the event a surface does not appear to be supporting a patient’s weight—and provided the support surface is the correct one—it is important to check for any disconnected hoses or improper machine settings. It may also be necessary to contact the appropriate hospital department, supplier, or manufacturer to have the support surface checked as needed. It is also important to ensure that all staff caring for the patient are aware of the features of the support system (EPUAP/NPIAP/PPPIA, 2019).
Managing Moisture

Moisture can lead to skin damage of various types. Incontinence-associated dermatitis (IAD) is the most common form of moisture-associated skin damage and is frequently misidentified as a pressure injury. While they are not the same thing, preventing IAD can also help to prevent the formation of pressure injuries.

TYPES OF SKIN DAMAGE DUE TO MOISTURE

Moisture-associated skin damage (MASD) is defined as inflammation and erosion of skin caused by prolonged exposure to various sources of moisture, including urine or stool, perspiration, wound exudate, mucus, or saliva. The four forms of MASD are:

- Incontinence-associated dermatitis (IAD)
- Intertriginous dermatitis (ITD)
- Periwound moisture-associated skin damage
- Peristomal moisture-associated skin damage
  (WOCN, 2016b; EPUAP/NPIAP/PPPIA, 2019)

**Incontinence-associated dermatitis** due to urinary incontinence may involve the perineum and the area between the vulva and scrotum or anus. IAD due to fecal incontinence may involve the anus, buttocks, coccyx, perigenital areas, groin folds, and posterior thigh regions. Its characteristics are moist, bright-red skin, inflammation, denudement (skin stripped raw), erosion, and blisters. The damage is usually superficial but can progress to full-thickness lesions. The patient will complain of burning, pain, and itching.

Moisture alone causes maceration, but acute inflammation and skin loss are due to a combination of maceration and some other source of injury such as a chemical irritant, friction, or pathogenic invasion. Wet skin loses strength and is more prone to damage from friction and shearing. It allows irritants to penetrate the epidermal layers of skin, which then allows common pathogens such as *Candida* and *Staphylococcus* to enter (WOCN, 2016b).

**Skin injury by friction** appears as redness and progresses to abrasion. It occurs when skin is rubbed vigorously during cleaning or when skin rubs against incontinence garments or bed or chair surfaces. Areas of skin rubbing against each other cause “kissing” lesions such as are seen between the buttocks cheeks.

Mechanical damage (friction) abrades and disrupts the skin from the “top down,” whereas pressure and shear cause blood vessel compression and ischemic damage from the “bottom up.” Determining the cause of the lesion—and distinguishing between IAD and a pressure injury—includes an assessment of the location, characteristics, and most importantly, the patient’s history.
DISTINGUISHING TYPES OF DAMAGE DUE TO MOISTURE

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<tr>
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<th>Friction (top down)</th>
<th>IAD (top down)</th>
<th>Pressure/Shear (bottom up)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Location</strong></td>
<td>Fleshy surfaces exposed to repetitive rubbing</td>
<td>Perineal area, inner thighs, buttocks</td>
<td>Bony prominences, under medical devices</td>
</tr>
<tr>
<td><strong>Depth</strong></td>
<td>Superficial</td>
<td>Superficial</td>
<td>Full thickness</td>
</tr>
<tr>
<td><strong>Characteristics</strong></td>
<td>Pink/red wounds without necrosis</td>
<td>Edges indistinct, fungal rashes common, pink/red wounds without necrosis</td>
<td>Well-defined lesions, tunneling and undermining, tissue necrosis</td>
</tr>
<tr>
<td><strong>History</strong></td>
<td>Restlessness, frequent sliding, malnourished, diaphoretic, on steroids</td>
<td>Prolonged or recurrent exposure to urine and/or stool</td>
<td>Prolonged immobility, sliding, use of medical device at site of damage</td>
</tr>
</tbody>
</table>

(WOCN, 2016b)

MANAGING INCONTINENCE

It is important to **cleanse skin gently** with a pH-balanced cleanser at each incidence of soiling. Perineal skin cleansers are more effective for prevention and treatment of IAD than traditional soap and water. This is because bar soap, which is alkaline and very drying, disrupts the skin’s protective abilities. Vigorous cleaning, as well as the use of rough washcloths, can also lead to skin erosion. Soft, disposable cloths are easier on the skin. Fragrance or alcohol are irritants, and cleaning products containing these are to be avoided. Some facilities use no-rinse foams, which are another good option.

An incontinence **skin barrier product** should be used to protect the skin after cleansing. Products such as creams, ointments, pastes, or those that form a film on the skin are all useful. Protective products with dimethicone, petroleum, or zinc oxide are recommended for patients with fecal incontinence or both urinary and fecal incontinence to protect against IAD. Several manufacturers offer products that both clean and protect, saving time for the caregiver and increasing the likelihood that perineal care will be performed.

**Absorbent underpads or incontinence briefs** are chosen to wick moisture away from the skin instead of trapping the moisture against the skin. However, all briefs increase moisture at the perineal region because they are occlusive and do not “breathe.” This creates warmth near the skin that, when combined with moisture, ammonia, and enzymes, increases skin breakdown. There is an increased risk with the use of briefs because they may not be changed as often as they should be due to the difficulty in seeing when a patient has voided. Briefs are not recommended for fecal incontinence because they can trap stool against the skin.
Many hospitals have moved away from using briefs except when a patient is ambulating or going off the unit. Instead, they use underpads that are especially designed to keep the skin dry and breathable and do not allow heat or moisture to be trapped against the skin.

A toileting program can also decrease incontinence and thus IAD. In situations where the severity of urinary incontinence has contributed to or may contaminate an existing pressure injury, placing a urinary catheter may be indicated (WOCN, 2016a).

Much attention has been paid to infections related to the use of indwelling catheters, particularly since 2008, when the Center for Medicare and Medicaid Services changed reimbursement regulations, calling catheter-associated urinary tract infections (CAUTI) “preventable harm” and withholding payment for additional costs related to CAUTI treatment (WOCN, 2016c). Significant bacterial colonization occurs within a few days of catheter insertion, which can lead to infection. The prevention of CAUTI begins with the decision to not insert a catheter.

The CDC has developed guidelines for the appropriate use of indwelling catheters as follows:

- To manage urinary retention or bladder outlet obstruction
- To provide accurate urine output measurements
- To manage bladder short term following select surgical procedures
- To assist in the healing of perineal wounds at risk of contamination by urine
- To improve comfort at end of life
  (WOCN, 2016c)

Therefore, incontinence is not a valid reason for insertion of an indwelling catheter to replace alternative means of care for the incontinent patient. It can be used in the treatment of a wound but not in prevention, since the risk of CAUTI is too high (WOCN, 2016c).

### Types of Urinary Incontinence

<table>
<thead>
<tr>
<th>Type</th>
<th>Description</th>
<th>Causes/Associated Factors</th>
</tr>
</thead>
<tbody>
<tr>
<td>Urge incontinence</td>
<td>Involuntary loss of urine with an abrupt strong need to void; occurs with the involuntary contractions of the detrusor muscle or uncontrolled urethral relaxation</td>
<td>Associated neurological disorders include stroke, paraplegia, multiple sclerosis, Parkinsonism, or dementia.</td>
</tr>
<tr>
<td>Stress incontinence</td>
<td>Involuntary leakage of small amounts of urine with a rise in intra-abdominal pressure that occurs during coughing, sneezing, laughing, and physical activity</td>
<td>Often seen in women; causes include estrogen deficiency, weakness in pelvic floor musculature, urethral sphincter weakness, childbirth, and obesity.</td>
</tr>
</tbody>
</table>
### Functional incontinence

Having a functional urinary tract but unable or unwilling to get to the toilet to urinate

Often occurs in older adults; contributing factors include use of physical restraints, musculoskeletal dysfunction, unavailability of a urinal, visual impairment, impaired mobility, cognitive deficits, unfamiliarity of environment, and psychosocial difficulties.

### Overflow incontinence

Involuntary loss of urine secondary to overdistension of the bladder; results in the leakage of small amounts of urine due to an outflow obstruction or a hypotonic bladder

Common causes include medications, neurological conditions such as diabetic neuropathy or spinal cord injury, prostate enlargement, detrusor weakness, or urethra stricture.

### Mixed incontinence

Combination of other types of urinary incontinence, typically urge and stress incontinence

Common in older adults.

(WOCN, 2016c)

### OCCUPATIONAL AND PHYSICAL THERAPY AND INCONTINENCE

Occupational and physical therapists are both specialists in assessing, identifying, and treating the underlying impairments associated with urinary incontinence. Common interventions that can be implemented by these professionals may include:

- Pelvic floor muscle training (PFMT): a program of repeated pelvic floor muscle contractions, which involves specific and progressive learned exercises to consciously contract the pelvic floor muscles, found to be useful in preventing urinary incontinence, overactive bladder, and postvoid dribbling

- Scheduled toileting (i.e., timed voiding): monitoring and then matching of the individual’s typical toileting schedule

- Habit retraining: identifying the individual’s natural voiding pattern and developing an individualized toileting schedule

- Prompted voiding: establishing a routine in which a caregiver suggests voiding and provides assistance as needed

- Biofeedback: using an external sensor placed in close proximity to the anal orifice to detect contraction of the pelvic floor muscles in order to help the patient to identify and strengthen those muscles
Electrical stimulation: using electrodes placed in either the vagina or rectum to stimulate and strengthen pelvic floor muscles, thereby aiding pelvic floor muscle contractions

Research indicates that the use of a toileting routine in combination with medication and education results in decreasing urinary incontinence.

(APTA, 2016; Healthline, 2016; NAFC, 2018; Vasavada, 2019; WOCN, 2016c)

**TREATING FECAL INCONTINENCE**

Fecal incontinence occurs when structures controlling defecation do not function correctly, usually because of diarrhea, trauma to the structures, or nerve damage.

- **Causes of diarrhea** include anything that increases gut motility or decreases water absorption, including medications, certain foods, and diseases that cause intestinal inflammation.

- **Trauma** to the structures includes scarring from chronic inflammation (as in irritable bowel syndrome), radiation, surgery, and childbirth.

- **Nerve damage** can also be the result of childbirth or of spinal cord injury, multiple sclerosis, Parkinson’s disease, stroke, and diabetic neuropathy.

Those with cognitive difficulties may not perceive the need to defecate. Patients with fecal incontinence should be referred to a specialist for accurate diagnosis and appropriate treatment.

When the underlying cause cannot be treated, regulation of bowel function by promoting ideal stool consistency can lead to few or no periods of incontinence. **Modifying the diet** can help, as certain foods can exacerbate fecal incontinence, such as alcohol, caffeine, fruit, gas-producing foods, sugar-free products that contain sorbitol, and dairy products for those who are lactose-intolerant. Dietary fiber adds bulk and can improve passage of stool.

**Adequate fluid intake** is essential because dietary fiber pulls water into the feces; without adequate water the patient will have very dry stools that are difficult to pass.

**Emptying the bowel at regular intervals** through time-toileting, digital stimulation, or use of suppositories prevents incontinence because an empty rectum will not leak.

Incontinence containment products are useful in community settings, but a plan for skin protection must be in place. In hospital settings, fecal management systems can be used. A colostomy is also an option if everything else has failed and quality of life is severely restricted due to fecal incontinence (Gump & Schmelzer, 2016).
CASE

Ruth is an elderly woman living in a residential treatment facility. She ambulates with assistance, and requires hands-on assistance with toileting and self care. She has a stage 3 pressure injury on her sacrum that the nurse is treating per physician’s orders. The home health nurse has been educating the facility’s caregivers about the importance of keeping Ruth’s perineal skin clean, dry, and protected.

The nurse knows that exposure to urine can delay or prevent wound healing. Remembering that frequent dressing changes can also delay healing, the nurse advises the physician of Ruth’s incontinence and wound status. The nurse also asks the physician for referrals to physical therapy and occupational therapy in order to further evaluate Ruth.

After completing an initial evaluation, the physical therapist believes that Ruth would benefit from gait training with a front-wheeled walker in order to improve her ambulation safety. The occupational therapist also evaluates the patient and recommends a timed voiding program along with verbal voiding prompts, a raised toilet seat, and grab bars in the bathroom; he believes that Ruth’s mild cognitive decline would not make her a good candidate for biofeedback.

At the end of four weeks of following the timed voiding schedule, the nurse compares the wound’s condition and measurements and finds that there is now granulation tissue in the wound bed and that the wound size has decreased by 75%. The nurse and occupational therapist recommend long-term continuation of the individualized toileting regime to maintain continence and prevent further pressure injury.

Managing Nutrition

Malnutrition is associated with overall morbidity and mortality. Assessing the patient’s nutritional status must be part of the total assessment for pressure injury risk. A nutrition assessment should be performed upon admission and whenever there is a change in the patient’s condition that puts them at risk for malnutrition.

Malnutrition places patients at greater risk for developing pressure injury. Malnutrition is defined as the presence of two or more of the following characteristics:

- Unintended weight loss
- Loss of muscle mass
- Loss of subcutaneous tissue
- Localized or generalized fluid accumulation
- Decreased functional status

A low body mass index (BMI) is a factor related to pressure injury development. With a low BMI due to poor nutritional intake, there is a diminished quantity of subcutaneous tissue and
decreased protection of the skin. In studies conducted with ICU patients in the United States and in hospitalized patients in Australia, the prevalence of pressure injury was greatest among patients who were underweight or very obese (Efraim, 2018).

**NUTRITION ASSESSMENT PARAMETERS**

- Current weight and usual weight
- History of unintentional weight loss or gain (>5% change in 30 days or >10% change in 180 days)
- Body mass index (BMI)
- Food intake
- Dental health
- Ability to chew, swallow, and feed oneself
- Medical and/or surgical history that influences intake or absorption of nutrients
- Drug-food interactions
- Psychosocial factors that can affect food intake
- Ability to obtain and pay for food
- Facilities for cooking and eating
- Food preferences
- Cultural and lifestyle influences on food selection
- Over 65 years of age

The patient should be monitored for signs of dehydration, such as decreased skin turgor and/or urine output or elevated serum sodium. Serum protein tests, such as for albumin and pre-albumin, may be affected by inflammation, renal function, and hydration and so may not correspond with overall nutritional status. Thus, laboratory tests should be considered as only one part of the nutritional assessment.

Recent weight loss in older adults is a key factor in mortality risk. The “anorexia of aging”—which includes appetite decline, weight loss, and decreased metabolic rate—places the older adult at risk for malnutrition. While unintended weight loss is a risk factor for malnutrition, bariatric adults may also be poorly nourished (Bryant & Nix, 2016).

Following are dietary recommendations for those who are at risk or have an existing pressure injury and who are at risk for malnutrition:

- Calorie intake of 30 kcal to 35 kcal per kg of body weight
- Protein intake of 1.25 g to 1.5 g protein per kg of body weight
• Supplementation with high-calorie, high-protein, arginine (an amino acid), and vitamins and minerals when nutritional needs cannot be met with dietary intake
• Adequate daily fluid intake

Renal function is also assessed to ensure that high levels of protein are appropriate for the patient (Baranoski & Ayello, 2016; EPUAP/NPIAP/PPPIA, 2019).

Any patient with nutritional and pressure injury risks, suspected or identified nutritional deficiencies, or a need for nutritional supplementation to prevent undernutrition should be referred to a registered dietitian. Any patient with a pressure injury should be referred to the dietitian as well (WOCN, 2016a).

Emerging Therapies for Pressure Injury Prevention

Emerging therapies for pressure injury prevention include microclimate manipulation, fabrics designed to reduce shear and friction, and use of prophylactic dressings (WOCN, 2016a).

MICROCLIMATE CONTROL

Microclimate is the term used to describe the local tissue temperature and moisture at the body/support interface, and microclimate control is a function of some support surfaces. This feature can be of benefit to patients who are diaphoretic (sweat heavily) or with elevated temperatures and perspiration, since they are at increased risk for developing pressure injuries. For instance, elderly patients have a reduced ability to dissipate excess heat, resulting in skin warming. High levels of moisture from perspiration, incontinence, or drainage result in maceration, which reduces skin strength and increases damage caused by friction (WOCN, 2016b; Bryant & Nix, 2016; EPUAP/NPIAP/PPPIA, 2019).

The need for moisture and temperature control should be considered when selecting a support surface. A support surface with microclimate control can help maintain normal skin hydration and temperature through the use of porous covers that promote air transfer between the skin and surface, which results in the decrease of moisture and body heat. Other surfaces pump air through microperforations in the support cover to decrease moisture and heat (WOCN, 2016a).

FABRICS

Silk-like fabrics rather than cotton or cotton-blend fabrics can be used to reduce friction and shear. Research has shown that the use of silk-like fabric undergarments, booties, and linen (alone or in combination) significantly reduces the incidence of pressure injury development and reduces the deterioration of existing pressure injuries (Freeman, 2017; EPUAP/NPIAP/PPPIA, 2019).
PROPHYLACTIC DRESSINGS

A polyurethane foam dressing can be applied prophylactically to bony prominences (e.g., heels, sacrum) to reduce friction, shearing, and moisture damage and thereby help prevent pressure injuries in anatomical areas frequently subjected to friction and shear. Trials have indicated that the application of specialty foam dressings to the sacrum is effective in reducing the rate of pressure injury in ICU patients and in nursing home residents who are at high risk for pressure injury development. Research also indicates that the application of multilayer foam dressings to the sacrum of patients before undergoing cardiac surgery greatly reduces the incidence of pressure injury in the immediate postoperative period (first five days in the ICU and progressive care units) (Strauss et al., 2019; EPUAP/NPIAP/PPPIA, 2019).

Considerations when selecting a prophylactic dressing include:

- Ability of the dressing to manage microclimate
- Ease of application and removal
- Ability to regularly assess the skin
- Anatomical location where the dressing will be applied
- The correct dressing size based on area to be protected

Foam dressings have a greater ability to absorb moisture than film or hydrocolloids and often have easy-to-lift borders. They are also permeable to water vapor and gases. Some dressings adhere well but can damage fragile skin on removal. All other preventive measures must be continued along with the dressings; the skin must still be inspected daily and the dressings replaced as needed (Ayello & Baranoski, 2016; EPUAP/NPIAP/PPPIA, 2019).

Preventing Pressure Injury in Special Populations

PATIENTS WITH MEDICAL DEVICES

With the recognition that the use of medical devices can contribute to pressure injury formation, NPIAP has also developed “Best Practices for Prevention of Medical Device-Related Pressure Injuries (MDRPI)” (NPIAP, 2016b; EPUAP/NPIAP/PPPIA, 2019). These include:

- Choose the correct size of medical devices to fit the individual.
- Cushion and protect the skin with dressings in high-risk areas (e.g., nasal bridge).
- Remove or move the device daily to assess skin.
- Avoid placement of devices over sites of prior or existing pressure injury.
- Educate staff (and caregivers) on correct use of devices and prevention of pressure injury.
- Be aware of edema under devices and potential for pressure injury.
• Confirm that devices are not placed directly under an individual who is bedridden or immobile.

• Ensure that all members of the patient care team, particularly respiratory therapy, are involved in the plan for reduction of MDRPI.
  (Camacho-Del Rio, 2018)

BARIATRIC PATIENTS

Pressure injury prevention and treatment for bariatric patients is similar to that for nonbariatric patients; however, it is also more challenging for a number of reasons:

• The bariatric patient has increased difficulty moving, either independently or with assistance.

• Increased body weight makes it difficult to view bony prominences and to redistribute pressure.

• Shear and friction are often increased, as the patient is inclined to drag the heels and sacrum when getting out of bed.

• The increased pressure on the bowel and bladder from abdominal weight increases the risk of stress incontinence and diaphoresis, which increases the risk of skin maceration.

• Obesity can compromise respiration due to impaired diaphragmatic movement and lead to subsequent impaired tissue perfusion.

• Pressure injuries develop over bony prominences but may also result from tissue pressure across the buttocks and other areas of high adipose tissue concentration. They may develop in unique locations, such as underneath folds of skin and in locations where devices may have been compressed between skin folds.

• The weight of the pannus (the skin “apron”) can cause pressure injuries to develop in areas such as the hip, thighs, trunk, and torso.

• Skin must be checked for maceration, which is common due to increased diaphoresis.

• Additional positioning devices may be needed to offload the pannus or other large skin folds.

• Infection and delayed healing are more common.

• Deeper tissue layers can impede assessment of cavity wounds and increase the risk of retained wound dressings.

• Equipment must be provided that is the appropriate size and great care taken that neither the patient nor the staff are injured during the provision of care.
  (Bryant & Nix, 2016; EPUAP/NPIAP/PPPIA, 2019)
INTERTRIGINOUS DERMATITIS

It is important that the clinician recognize the difference between intertriginous dermatitis (intertrigo) and stage 1 and 2 pressure injuries. Intertrigo is an inflammatory skin condition that affects opposing skin surfaces, caused by trapped moisture and friction between the opposing skin folds (i.e., skin rubbing against skin) (WOCN, 2016b).

Intertrigo can progress to severe inflammation with mirrored areas of skin erosion or even ulceration. Linear skin tears at the base of the skin fold occur when the skin is pulled or stretched when skin folds are separated, such as occurs during cleaning. Complications include secondary infections such as candidiasis and bacterial infections. These erosions and skin tears are not pressure injuries.

Bariatric patients are at high risk for this dermatitis because their multiple skin folds form ideal conditions for inflammation and maceration. The differentiation on whether the lesion is intertrigo or a pressure injury is based on the etiology of the skin damage and the appearance (see the definitions of stage 1 and 2 pressure injuries later in this course). The most common areas for intertrigo to develop are under the pannus, the breasts, between the buttock cheeks, and in the groin or perineum.

PEDIATRIC PATIENTS

There is growing awareness that pressure injuries can be the basis of illness, suffering, and increased cost of care in the pediatric population. A study assessing neonatal ICU unit patients found that almost 80% of pressure injury present was device related, and over 90% of MDRPI developed in premature infants. Statistics demonstrate little change in the incidence of pediatric pressure injuries since 2010 (Delmore et al., 2019).

Pressure injuries in children cannot be presumed to be uncommon, and a pressure injury risk assessment is as important in this population as it is in adults. There are pressure injury risk assessment tools for pediatrics. Two of them are the Braden Q and the Pediatric Pressure Ulcer Prediction and Evaluation Tool (PPUPET).

The most recently developed instrument for measuring pressure injury in the pediatric population, the Braden QD, was presented in 2018. It is based on the original Braden Q scale and intended for use in neonates to patients 21 years of age. The Braden QD scale incorporates the five subsets of the Braden Q scale along with the inclusion of two new subsets: the number of medical devices in use and patient repositionability/skin protection (Curley et al., 2018).

Several factors are associated with pediatric pressure injury development:

- Low birth weight
- Skin texture (e.g., neonatal skin is very thin)
- Incubator temperature and humidity
• Support surface used
• Limited position changes
• Endotracheal intubation
• Incontinence
• Poor tissue perfusion
• Fever
• Larger head proportion to the body, putting the occiput at high risk for pressure injury development

Consider children with medical devices to be at greater risk for pressure injuries. At particularly high risk are those with mechanical ventilation, including tracheostomies, CPAP or BPAP, and ECMO. One study found that 35% of pressure injuries resulted from tracheostomy fixation devices (Delmore et al., 2019). Pressure injury at the tracheostomy site can be due to the fact that the device rests directly on the patient’s skin. The pressure injury can occur directly under the tracheostomy tube or at different location under the ties used to secure the tracheostomy tube in place (Odom et al., 2020).

Increased temperatures, moisture, and humidity under medical devices and their securement can greatly increase the risk for pressure injury in pediatric patients. Proactive, preventive care should be the primary goal for clinicians, and the use of absorptive dressings under medical devices should be used whenever feasible (Boyar, 2019b).

Many pediatric patients with medical device–related pressure injury are younger, with premature infants being particularly vulnerable. One of the major reasons for this vulnerability is immature skin, with neonates and infants under 2 years of age at the highest risk level.

Neonates have a much thinner stratum corneum, which is the outermost layer of the epidermis, compared to full-term infants. For neonates less than 24 weeks of gestational age, the stratum corneum maybe almost completely absent. Another factor that predisposes the premature skin of pediatric patients to pressure injury is the reduced interconnection between the epidermal and dermal layers of the skin. This places the premature skin of neonates at greater risk for damage associated with friction (Delmore et al., 2019).

There is limited information available on healing times for pressure injuries in the pediatric population. One small study that included pediatric patients with pressure injuries at stages 2 to 4 demonstrated an average healing time of 13 days. However, more detailed research needs to be done in this area, taking into consideration the gestational age of the infants and comorbidities. A retrospective study done at Arkansas Children’s Hospital found that the use of a foam dressing and wound filler silver product during the first 14 days of treatment assisted with healing of tracheostomy-related pressure injuries (Odom et al., 2020).

Immobility-related pressure injury is another major area of concern in the pediatric population. The occipital region is the area most often affected by immobility-related injuries especially in

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infants from birth to three years of age. In infants the head encompasses a higher percentage of body weight and surface area, and when the pediatric patient is lying supine, the occipital area is the main pressure point and at substantial risk for pressure injury (Bryant & Ayello, 2016).

As in adults, assessment and monitoring, involvement of the family, nutritional management, support surfaces, and repositioning are important. Wound care strategies and dressing selections must be taken with great care, as baby skin is more permeable and more fragile than adult skin, with the result that products commonly used on adults may not be appropriate for children, such as skin preps, barrier products, antimicrobials, and adhesives. Wound care product choices should be discussed with pediatric specialists (EPUAP/NPIAP/PPPIA, 2019).

**SPINAL CORD INJURY PATIENTS**

The development of pressure injury is of special concern to individuals with spinal cord injury. Pressure injury is the second most frequently occurring medical complication among those with spinal cord injury. Data demonstrate that >95% of adults with spinal cord injury will develop one or more pressure injuries during their lives. Lack of mobility and paralysis is a key factor in pressure injury occurrence; the greater the level of paralysis, the greater the risk for the development of pressure injury.

In a study of community-dwelling individuals with spinal cord injury, it was found that those with spinal cord injury at the cervical level had a higher risk of developing a pressure injury compared to those with a spinal cord injury at the lumbar level (Cowan et al., 2019).

In another study of individuals with spinal cord injury living in long-term care facilities, researchers found a higher incidence of pressure injury in patients who were paraplegic than those who were tetraplegic. This may be because patients who are tetraplegic require total care from the facility staff, whereas patients who are paraplegic have more responsibility for making position shifts aimed at relieving pressure, especially when sitting. Another finding was a greater risk for malnutrition in patients with paraplegia compared to those with quadriplegia, perhaps due to a greater calorie use in paraplegic patients due to upper body mobility and potential unaddressed difficulties with independent feeding in this group.

Recommendations include the implementation of greater preventive measures among long-term care patients who are paraplegic to prevent pressure injury. Specific suggestions included closer and more consistent monitoring of this high-risk population, better utilization of assistive technology, and increased patient motivation and education regarding pressure injury prevention (Cowan et al., 2019).
STAGING PRESSURE INJURIES

Pressure injuries are staged to classify the degree of tissue damage that is present. The staging system was originally created in 1975 as a means to describe the amount of anatomical tissue loss in a pressure injury. The use of stages in pressure injury assessment is a way to classify the amount and type of tissue destroyed based on anatomic depth. Having and using a common classification system allows all clinicians a way of communicating accurately about what is wrong. It is only used to describe pressure injuries, not other wounds.

The clinician must first determine the etiology of the injury being assessed and the presence of pressure and/or shear. If these factors are not present, the injury is not a pressure injury. First, the injury is cleansed to remove loose debris and to validate the etiology is pressure or shear; then the staging system is used to stage the injury appropriately. When labeling a pressure injury, it is important to use correct anatomical terms to identify its location on the body.

Stage 1 Pressure Injury

A stage 1 pressure injury is indicated by intact skin with a localized area of nonblanchable erythema, usually over a bony prominence. Darkly pigmented skin may not have visible blanching; its color may differ from the surrounding area. Presence of blanchable erythema or changes in sensation, temperature, or firmness may precede visual changes. Color changes in stage 1 pressure injuries do not include purple or maroon discoloration; these may instead indicate deep tissue pressure injury (see “Deep Tissue Pressure Injury” below).

Blanchable erythema (redness) means that when the red area is compressed by the finger, the area turns white or pale and the redness returns when the pressure is released. Nonblanchable erythema means the area under the finger remains red as it is compressed. Nonblanchable redness indicates that tissue damage has already occurred.
Stage 1 pressure injury on a patient’s buttocks/coccyx.
(Source: © 2011, Gordian Medical, Inc., dba American Medical Technologies, used with permission.)

**TERMINOLOGY**

- **Slough** is a soft, moist, avascular tissue. It may be white, yellow, tan, or green; loose or firmly adherent; and described as resembling chicken fat.

- **Eschar** is black or brown necrotic tissue. It can be loose or firmly adherent; hard, soft, or boggy; and look like a scab, although there is no healing occurring beneath it.
• **Undermining** is tissue destruction to underlying, intact skin along the wound edges.

• **Tunneling** is a path of tissue destruction that occurs in any direction from the surface or edge of the wound.

(See also wound injury images below.)

**Stage 2 Pressure Injury**

A stage 2 pressure injury is indicated by **partial-thickness loss of skin with exposed dermis** (see images). The wound bed is viable, pink, or red; moist; and may also present as an intact or ruptured serum-filled blister. Adipose (fat) and deeper tissues are not visible. Granulation tissue, slough, and eschar are not present. These injuries commonly result from adverse microclimate and shear in the skin over the pelvis and shear in the heel.

It is especially important that the presence or history of pressure and/or shear be confirmed in a suspected stage 2 pressure injury. This stage should not be used to describe moisture-associated skin damage (MASD), including incontinence associated dermatitis (IAD), intertriginous dermatitis (rashes in skin folds), medical adhesive–related skin injury, or traumatic wounds (skin tears, burns, abrasions).

Stage 2 pressure injuries heal by reepithelialization and not by granulation tissue formation (i.e., by return of intact skin and not by scarring). At times the superficial fascia under the dermis is visible and evident as a thin, ivory-colored, nonremovable layer. A viable dermis is pink or red, shiny, and blanchable; it is not granular.

“Partial thickness” means that the damage is confined to the epidermis and/or dermis but does not penetrate below the dermis.

![Stage 2 Pressure Injury](image-url)

*Note reddened wound edges.* (Source: © NPUAP, used with permission.)
Stage 3 Pressure Injury

A stage 3 pressure injury is indicated by full-thickness loss of skin in which adipose (fat) is visible in the ulcer and granulation tissue and epibole (rolled wound edges) are often present (see images). Slough and/or eschar may be visible. Undermining and tunneling may occur. Fascia, muscle, tendon, ligament, cartilage, and/or bone are not exposed. When slough or eschar obscures the extent of tissue loss, the injury is considered unstageable.

The depth of a stage 3 pressure injury varies by anatomical location. The bridge of the nose, ear, occiput, and malleolus do not have subcutaneous tissue, and stage 3 injuries here will be shallow. In contrast, areas of significant fat deposits can develop extremely deep stage 3 pressure injuries. Accurate staging is based on assessment of the extent of damage and the visible tissue layer, not depth.
Stage 3 Pressure Injury with Epibole

(Source: © NPUAP, used with permission.)

Stage 3 pressure injury on a patient’s ankle.
(Source: © 2011, Gordian Medical, Inc., dba American Medical Technologies, used with permission.)
Stage 4 Pressure Injury

A stage 4 pressure injury is indicated by full-thickness skin and tissue loss with exposed or directly palpable fascia, muscle, tendon, ligament, cartilage, or bone in the ulcer (see images). Slough and/or eschar may be visible. Epibole (rolled edges), undermining, and/or tunneling often occur. Depth varies by anatomical location. As bone may be in the ulcer, clinicians should consider the presence of osteomyelitis in stage 4 pressure injuries. When slough or eschar obscures the extent of tissue loss, the injury is considered unstageable.

(Source: © NPUAP, used with permission.)

Stage 4 pressure injury on a patient’s ankle.
(Source: © 2011, Gordian Medical, Inc., dba American Medical Technologies, used with permission.)
Unstageable Pressure Injury

An unstageable pressure injury is indicated by full-thickness skin and tissue loss in which the extent of tissue damage within the pressure injury cannot be confirmed because it is obscured by slough or eschar (see images). If slough and eschar is removed, a stage 3 or stage 4 pressure injury will be revealed because slough and/or eschar do not form in stage 1 or 2 injuries.

Clinicians should bear in mind that “unstageable” refers to the inability to visualize the wound base rather than the clinician’s inability to determine the injury stage.

Stable eschar (i.e., dry, adherent, intact without erythema or fluctuance) on the heel or ischemic limb should not be softened or removed. Stable eschar acts as the body’s natural or biological cover dressing. Removing stable eschar in the poorly perfused area results in an open wound that may expose the body to infection and decrease the ability to heal. Treat stable eschar on a poorly perfused area as dry gangrene; do not moisten or soften it. The most important intervention when managing this type of injury is pressure redistribution rather than eschar removal. As the eschar loosens from the wound bed, trim the edges to avoid inadvertent removal.

Unstageable pressure injuries. (Source: © NPUAP, used with permission.)

Unstageable pressure ulcer. (Source: © AAWC, used with permission.)
Deep Tissue Pressure Injury

A deep tissue pressure injury (DTPI) is indicated by intact or nonintact skin with localized area of persistent nonblanchable, deep red, maroon, purple discoloration or epidermal separation revealing a dark wound bed or blood-filled blister (see images). Pain and temperature change often precede skin color changes. Discoloration may appear differently in darkly pigmented skin. DTPI is not used to describe vascular, traumatic, neuropathic, or dermatologic conditions.

This injury results from intense and/or prolonged pressure and shear forces at the bone-muscle interface. The wound may evolve rapidly to reveal the actual extent of tissue injury, or may resolve without tissue loss. If necrotic tissue, subcutaneous tissue, granulation tissue, fascia, muscle, or other underlying structures are visible, this indicates a full-thickness pressure injury (unstageable, stage 3, or stage 4).

It must be confirmed that the purple skin (appearing as ecchymoses or bruising) is due to pressure or shear and not a response to medication or trauma. Identifying the timing and setting of the pressure/shear that led to the deep tissue pressure injury will help in analyzing the cause. Documentation includes the evolution of the injury after discovery (sloughing of the epidermis that reveals deeper tissue damage) and, if injury becomes full thickness, the stage of the resultant injury.

(Source: © NPUAP, used with permission.)
Additional Pressure Injury Definitions

The National Pressure Injury Advisory Panel (2016a) has also defined two additional types of pressure injuries, described below.

**MEDICAL DEVICE–RELATED PRESSURE INJURY**

Medical device–related pressure injuries (MDRPIs) result from the use of devices designed and applied for diagnostic or therapeutic purposes. The resultant pressure injury generally conforms to the pattern or shape of the device. The injury should be staged using the same staging system.

The skin must be examined under the device. Some devices are easily removed or moved for assessment; others may require two people to assist, such as under a tracheostomy if the patient is agitated and likely to grab at the device. Pressure reduction under a medical device can occur when thin dressings are applied between the device and the skin. These dressings (thin silicone foams, hydrocolloids, etc.) should be applied before the device is applied, as it may be difficult to lift the device later to apply the dressing.

This type of wound should be documented, for example, as “stage 4 pressure injury on bridge of nose from a medical device.” The name of the device should be included in documentation to allow for analysis of the injury.

Research has shown that MDRPIs develop more quickly than pressure injuries not caused by medical devices. The most common sites for MDRPIs are the ears and feet (Kayser et al., 2018).
MUCOSAL MEMBRANE PRESSURE INJURY

Mucosal membrane pressure injury is found on mucous membranes with a history of a medical device in use at the location of the injury (see image). Mucosal tissues are especially vulnerable to pressure from medical devices such as oxygen tubing, endotracheal tubes, bite blocks, nasogastric tubes, urinary catheters, and fecal containment devices.

Because the staging system for pressure injuries is based on the anatomy of the skin, it cannot be used to stage mucosal pressure injuries. Nonblanchable erythema cannot be seen in mucous membranes; shallow open ulcers indicating superficial skin loss in the epithelium are so shallow that the naked eye cannot distinguish them from deeper, full-thickness ulcers.

The injured mucosal membrane is often inflamed and may be tender and edematous. It does not form slough or eschar. Scars do not form in mucous membranes. The medical device should be repositioned to reduce pressure. Stabilizing systems can be used to hold tubes in place without pressure.

Since the staging system cannot be used, the clinician should document the pressure injury as a “mucosal membrane tissue injury” on the body area (lip, urethra, nares, tongue, labia, etc.) and document the name of the actual device that caused the injury.

Reverse Staging

The term reverse staging came about in the 1980s as a way of describing improvement in a pressure injury. However, this term does not accurately describe what is physiologically occurring in the injury. Because staging is used only to describe the amount and type of tissue destroyed based on anatomic depth, it cannot be used to describe healing. (Documentation should not include reverse staging.)
As a pressure injury heals, it does decrease in depth, but the body does not replace the lost bone, muscle, subcutaneous fat, or dermis. Instead, the full-thickness injury is filled with granulation, or scar tissue, and then covered with new epithelium. Even a partial-thickness stage 2 injury does not return to the nonblanchable redness of a stage 1 injury. A stage 4 pressure injury that has closed should be classified as a closed stage 4 pressure injury. If a pressure ulcer reopens in the same anatomical site, the ulcer resumes the previous staging diagnosis—once a stage 4, always a stage 4 (EPUAP/NPIAP/PPPIA, 2019).

EARLIER CLARIFICATIONS TO NPIAP GUIDELINES

On January 24, 2017, the NPIAP (then NPUAP) issued “Position Statement on Staging—2017 Clarifications” to address the many requests it had received for clarification of its 2016 pressure injury guidelines. The statements are summarized here.

Position Statement 1: The diagnosis of a “pressure injury” does not mean that the healthcare provider(s) “caused” the injury. Pressure injury simply means the tissue is injured by pressure (and/or shear). It does not assign blame or in any way imply that the injury was “caused” by anything that healthcare providers “did” or “failed to do.” The word injury occurs frequently in the medical literature (e.g., kidney injury, spinal cord injury, closed head injury) to identify the existence of tissue injury, without assigning blame.

Position Statement 2: Some pressure injuries are unavoidable despite provision of evidence-based care by the healthcare team. NPUAP has long maintained that some pressure injuries are unavoidable. Evidence must be presented to support a theory of causation based on a careful analysis of the preventive care provided (or not provided) to the individual in accordance with acceptable standards of evidence-based pressure injury prevention.

Position Statement 3: The numerical staging system does not imply linear progression of pressure injuries from stage 1 through stage 4, nor does it imply healing from stage 4 through stage 1. NPUAP has long maintained this position and issued a position statement against “down staging” as early as the year 2000.

Position Statement 4: The NPUAP Staging System classifies pressure injuries based on the type of tissue loss that can be visualized or directly palpated. Pressure injuries can be staged if the type of tissue injured can be visualized or directly palpated (as with stage 4, when exposed bone is visible or directly palpated). But because there are limitations to what can be seen, two additional options for staging are provided: 1) unstageable pressure injuries to address situations where the wound base is obscured by slough and/or eschar and 2) deep tissue pressure injury (DTPI), where the skin may be intact but is purple or maroon, indicating deeper tissue damage has occurred.
Position Statement 5: The pressure injury may be more extensive than initially apparent. The wound base and surrounding tissue should be assessed for variations in sensation, temperature, firmness, color, and any expression of drainage from surrounding tissues when palpated. Tissue surrounding the “visible injury” should be assessed for changes (e.g., pain, temperature, firmness, color, and drainage) which may alert the clinician to more extensive damage than is readily visible. Additional findings should be described and documented.

Position Statement 6: Deep tissue pressure injury (DTPI) may evolve into a full-thickness wound despite optimal care. A DTPI may evolve rapidly to reveal the actual extent of tissue injury, or may resolve without tissue loss. Off-loading the area still offers the best chance for tissue that is ischemic or injured but not infarcted.

Position Statement 7: Any pressure injury should be treated in accordance with current evidence-based practices and monitored closely for changes that require reevaluation of treatment strategies.

NPUAP Staging System revisions are designed to improve the accuracy of staging when reporting “new” or “worsening” pressure injuries. NPUAP will continue to work with CMS (Center for Medicare and Medicaid Services) on further refinements of quality measures to more accurately monitor healing versus deterioration.

(NPIAP, 2017)

PRESSURE INJURY TREATMENT

Treating a pressure injury involves all of the activities used in preventing a pressure injury: the proper pressure-reducing surface, repositioning the patient correctly and frequently, maintaining intact skin, and improving nutrition. While these interventions are started, the treatment of the wound itself also begins. There are basic wound care principles that can be used in deciding which treatments will be the best for the wound and for the patient. Frequent reassessment of the wound and its response to the treatment is required, as well as eliminating or reducing the factors that inhibit wound healing.

Of all the interventions that must be done to heal the injury, pressure reduction measures are the most important. Simply put, the wound will not heal unless the pressure is removed. Trying to heal a pressure injury without reducing the pressure is like trying to heal a stab wound with the knife still in it. There might be some improvement, but the wound will never heal because the primary cause has not been removed. (Techniques to reduce pressure are discussed earlier in this course.)
The object of pressure injury treatment is to reproduce (to the best of one’s ability) the normal environment of the exposed tissue of the wound. The normal environment of all tissue and cells, with the exception of the epidermis, is warm, dark, moist, and protected.

In order to heal any wound, including pressure injuries, some **basic principles and management strategies** need to be followed. The strategies for pressure injury treatment are:

- Cleanse the wound and periwound at each dressing change.
- Manage wound infections.
- Debride the pressure ulcer of devitalized or necrotic tissue.
- Utilize appropriate dressings.

Some of these strategies will require medical intervention; others, good clinical care. By carrying out these strategies, caregivers will provide the wound with the environment it needs to heal (WOCN, 2016a; EPUAP/NPIAP/PPPIA, 2019).

**Pain Management**

Before treatment begins, clinicians address the patient’s pain. Pressure injuries hurt. The pain may be constant and severe, and it may be the most distressing pressure injury symptom that the patient reports. Pressure injury **pain can be caused by**:

- Pressure, friction, shear
- Damaged nerve endings
- Inflammation
- Infection
- Procedures and treatments
  
  (Bryant & Nix, 2016)

Multiple studies have shown that the pain increases as the stage increases (WOCN, 2016a). The words most frequently used to describe pressure injury pain in all stages (2–4) include “tender,” “hurting,” “burning/hot burning,” “sharp,” “throbbing,” and “aching.” The pain can occur when the patient is at rest and when no treatments are being done. The greatest pain occurs with dressing changes and wound care. Thus, pain must be assessed before, during, and after wound care and prevented/treated accordingly.

It should not be assumed that because the patient is paralyzed that the body cannot feel or respond to pain. Similarly, it should not be assumed that the patient with dementia, who never complains of pain, does not in fact have pain. The clinician should assume that if the wound would cause oneself pain, it is causing the patient pain. Assess and treat accordingly.
Some wound care **strategies that can help reduce pain** are:

- Organize care to coordinate it with pain medication administration.
- Encourage patients to request a “time out” during procedures, and then be sure to give a time out.
- Reduce the pain by keeping the wound bed covered and moist and using a nonadherent dressing.
- Select dressings that require less frequent changes such as hydrocolloids, hydrogels, alginates, foams, and soft silicone dressings.
- Protect the periwound skin with liquid film barriers or barrier ointments or creams to prevent skin damage from drainage and tape stripping.
- Encourage repositioning as a way to reduce pain, and use appropriate support surfaces.
- Provide pain medication prior to procedures.
  
  (Bryant & Nix, 2016; EPUAP/NPIAP/PPPIA, 2019)

**Topical analgesics** can be applied to the wound prior to dressing changes. Topical lidocaine gels, creams, sprays, and patches are now available over the counter in concentrations as high as 5%. Lidocaine should be used with caution in wounds with large surface areas, as it can be absorbed through the wound and possibly cause neurologic or cardiovascular adverse side effects. EMLA cream (a eutectic mixture of local anesthetics, namely lidocaine and prilocaine) is another product used for topical analgesia. It must be in contact with the wound for at least 20 minutes under occlusion (e.g., plastic wrap over the top) and is quite effective (WOCN, 2016b).

**CASE**

Bill is a 76-year-old male with a history of multiple strokes (CVAs) and respiratory failure. He has a tracheostomy (but is able to breathe on his own), a G-tube for enteral feeding, and a urinary catheter. He’s been admitted with pneumonia and has community-acquired stage 4 pressure injuries on his sacrum and left ischium.

Bill cannot speak but makes eye contact, shakes his head yes and no appropriately to questions, and is usually smiling. He always shakes his head no when asked if he is having pain. After a few days of doing his wound care, the nurse notices that during care he is frowning, his breathing rate is a little faster, and he closes his eyes. When asked if he is having pain, Bill indicates no, but the nurse believes that he might be hurting.

The nurse discusses this with the physician, who agrees that a dose of oral pain medication can be given through the G-tube an hour before wound care. The physician also agrees to the nurse’s suggestion for the use of 2% lidocaine gel applied to the wound beds and allowed to remain in place for 10 to 15 minutes prior to wound care. With these additions to his care plan, Bill no longer frowns and seems a bit more relaxed during wound care. Bill’s son has noticed this as well and thanks the nurse for his father’s care.
Wound Cleansing

Cleansing is the important first step in preparing the pressure injury bed to heal by removing surface debris and dressing remnants and allowing better wound visualization for assessment. The goal is to flush away exudate without damaging tissues.

How often a pressure injury is cleansed is determined by the amount of drainage (e.g., heavily draining wounds may need to be cleansed three to four times a day), dressings used, and wound care treatment orders. The wound and periwound are cleansed at each dressing change, minimizing trauma to the wound.

While no specific studies demonstrate the superiority of a particular wound-cleansing product or technique for pressure injuries, the WOCN (2016a) offers the following recommendations:

CLEANSING SOLUTIONS

Most pressure injuries can be cleansed with potable water (i.e., water suitable for drinking), water that has been boiled and cooled, or normal saline. A pressure injury is a chronic, nonsterile wound and thus water is appropriate for cleaning. When possible, showering a patient using a hand-held spray can do a good job of cleaning the pressure injury and the surrounding skin.

Cleansing solutions with surfactants and/or antimicrobials can be used if there is confirmed or suspected infection. Surfactants help remove wound contaminants. Avoid using cleansing products or solutions in open pressure injuries that are intended for use on intact skin and/or designed to remove fecal material. These products can be toxic to the wound bed. Skin cleansers used on intact periwound skin are appropriate.

Aseptic techniques are to be considered if the patient or the wound is immunocompromised or if the wound enters a sterile body cavity.

CLEANSING TECHNIQUES

Techniques for cleansing may include irrigation, pressurized irrigation/pulsatile lavage, gently swabbing the wound, showering, or bathing.

Scrubbing devices such as cloths or sponges can increase the efficacy of the cleansing solution. However, it is important to minimize trauma to the pressure injury bed by using as little force as necessary to achieve cleansing. Wounds scrubbed with coarse sponges are at significantly higher risk for infection than wounds scrubbed with softer sponges (Krasner, 2014).

Pressurized irrigation may be needed in the presence of slough or necrotic tissue. Pressure should be adequate to clean the surface without causing trauma. This can be done with a 35 ml syringe and a 19-gauge needle or angiocatheter or with one of several commercial devices for this use. In many institutions, physical therapists perform these irrigations. Environmental contamination can occur, and thus infection control precautions should be routinely followed (WOCN, 2016a).
Cleanse **pressure injuries with tunneling or undermining** with caution to avoid instilling solution that might not be retrieved.

**Managing Wound Infections**

Pressure injuries are the consequence of ischemia and are more susceptible to the development of infection than other wounds since the tissue does not receive normal nutrition, oxygen, immune cells, antibodies, and antibiotics. Other risk factors for infection compromise the host’s defenses, such as malnutrition.

Infection is not common in stage 1 or 2 pressure injuries, so the focus on assessment of infection is on stage 3, 4, and unstageable injuries. In a study of hospitalized patients with pressure ulcers, 76% of the ulcers were infected, 50% of the patients had bacteremia, and the ulcers were a major reservoir of multidrug-resistant organisms (WOCN, 2016a).

**CLINICAL INDICATORS OF INFECTION**

In chronic wounds such as pressure injuries, bacteria may be present and interfere with wound healing without the classic signs/symptoms of infection being displayed. **Critical colonization** is a term used to describe the point at which bacteria on the wound’s surface interferes with healing. Signs of critical colonization include an unexplained plateau in healing, deterioration of granulation tissue, and increased drainage without odor.

Clinical indicators of **localized infection** include:

- New or increased pain
- Lack of signs of healing for two weeks
- Friable granulation
- Discolored tissue in the wound bed
- Changed or increased odor
- Increased drainage
- Induration (firmness)
- Necrotic tissue
- Pocketing or bridging

Clinical signs of **spreading or systemic infection** include:

- Erythema extending from the wound edges
- Induration
- New or increased pain
- Purulent drainage
• Increased size
• Crepitus or fluctuance
• Discoloration in the surrounding skin
• Fever and malaise
• Confusion, delirium, or anorexia, especially in older adults
  (EPUAP/NPIAP/PPPIA, 2019)

OTHER RISK FACTORS FOR INFECTION

In addition to the signs/symptoms of infection, the clinician should have a high index of
suspicion for the likelihood of infection in pressure injuries that:

• Have necrotic tissue or a foreign body present
• Have been present for a long time
• Are large in size or deep
• Are likely to be repetitively contaminated, such as those near the anus

And in individuals with:

• Diabetes
• Protein-calorie malnutrition
• Hypoxia or poor tissue perfusion
• Autoimmune disease
• Immunosuppression
  (EPUAP/NPIAP/PPPIA, 2019)

WOUND CULTURE

Wound cultures are used to confirm or modify the plan of treatment when antibiotic therapy is
indicated, and the results should be compared to the clinical picture (WOCN, 2016b). The gold
standard method for obtaining a culture is a tissue biopsy, as this reflects the bacteria invading
the wound, not just those on the surface.

However, a biopsy can be difficult to obtain, and thus the swab technique, while at high risk for
contamination by surface debris and skin contaminants, is the most commonly used. Because of
the high risk for contamination, it is imperative that clinicians use optimal technique when
obtaining the specimen (WOCN, 2016b).

There are two guidelines essential to accurate and valuable information. The first is adherence to
the optimal time frame for transport of the specimen to the lab. Use of culture specimen
containers and tubes that stabilize and fix the bacteria reduces the risk of bacterial replication or death and allows for a reasonable time frame for transport; this is particularly important for cultures obtained in the home, an outpatient center, or a skilled nursing facility. The second essential guideline is to carefully and accurately obtain the specimen.

Modern moisture retentive dressings are designed to maintain an ideal environment and are left in place for several days. The accumulated exudate found upon removal of these dressings usually contains bacteria from the surface of the wound and the surrounding skin. Swab cultures of this exudate are likely to generate high numbers of microbes that may not reflect actual bacterial status of the wound and can lead to initiation of systemic antibiotic therapy targeting organisms that are not negatively affecting the wound.

**SWAB TECHNIQUES**

A technique called the **Z-Stroke** involves starting at the top of the wound, pressing the swab into the wound surface, and moving it from skin edge to skin edge in a “Z” pattern down to the bottom of the wound. The probability of contaminating the swab with resident skin bacteria or devitalized tissue on the wound surface is high.

A second swab procedure, called the **Levine technique**, decreases the accidental contamination of the swab and begins with wound cleansing prior to the obtaining the swab culture. The procedure is as follows:

- Remove or debride nonviable tissue if appropriate, since necrotic tissue harbors high numbers of microorganisms that may not be affecting healing.
- Clean the wound with a nonpreserved, nonantimicrobial cleanser such as normal saline to remove surface debris and residual dressing material.
- Wait two to five minutes.
- If the ulcer is dry, moisten the swab with sterile normal saline.
- Culture the healthiest-looking tissue in the wound bed.
- Do not culture exudate, pus, eschar, or heavily fibrous tissue.
- Rotate the end of a sterile wound culture swab over a 1 cm square area for five seconds.
- Apply sufficient pressure to the swab to cause tissue fluid to be expressed.
- Use sterile technique to break off the tip of the swab into the collection device (or follow manufacturer’s directions) and get the specimen to the lab.
The most common bacteria identified in pressure injuries are *Staphylococcus aureus*, *Proteus mirabilis*, *Pseudomonas aeruginosa*, and *Enterococcus faecalis*.

**TREATING INFECTION**

In general, **topical antibiotics are not recommended** for treating pressure injuries. Patients with pressure injuries are at high risk for acquiring antibiotic-resistant organisms. In addition, there is concern over side effects, resistance, and hypersensitivity reactions. If needed, a short course of topical antibiotics (two-week) could be used in wounds that have been debrided and cleansed but still have high bacterial counts. Silver sulfadiazine could be useful; metronidazole can be used in the treatment of malodor in fungating wounds or wounds with anaerobic infections (Ayello & Baranoski, 2016).

**Systemic antibiotics** should be used in patients with clinical evidence of systemic infections, such as positive blood cultures, cellulitis, osteomyelitis, or sepsis.

Besides systemic antimicrobial treatment, the clinician can optimize the patient’s ability to combat infection by:

- Evaluating nutritional status and addressing deficits
- Stabilizing blood sugar control
- Improving arterial blood flow
- Reducing immunosuppressant therapy if possible
- Preventing contamination of the injury with meticulous skin cleansing and use of dressings to prevent exposure to fecal matter

(See also “Antimicrobial Dressings” later in this course.)

**Debridement: Removing Necrotic Tissue**

Removing necrotic tissue is a critical step when healing the pressure injury is the goal. By removing dead tissue, bacteria and the risk for infection are decreased along with drainage and odor. Removing necrotic tissue may also contribute to the release of available growth factors in the wound, thus allowing the cells to multiply and heal the wound.

The removal of necrotic tissue is called **debridement**, of which there are several types:

- Surgical/sharp
- Conservative sharp
- Autolytic
- Enzymatic
The most appropriate type of debridement will depend on the patient’s overall condition and goals of care. Factors to consider include the status of the pressure injury; the type, quantity, and location of the necrotic tissue; the presence or absence of infection; pain tolerance; the care setting; and professional accessibility (Ayello & Baranoski, 2016; EPUAP/NPIAP/PPPIA, 2019).

Removing the necrotic tissue will often reveal the true size of the pressure injury and the damage done—the “iceberg” effect. The patient and family should be educated that the pressure injury will look worse after debridement and that the ulcer cannot heal without debridement.

SURGICAL/SHARP DEBRIDEMENT

This form of debridement is performed by a surgeon or advanced practitioner at the bedside or in the operating room, using scalpel and scissors under general or local topical anesthetic. Surgical debridement extends into viable tissue, and the resultant bleeding helps stimulate production of growth factors to aid in healing.

Surgical debridement is the quickest way to remove extensive necrotic tissue, undermining, and tunneling. The benefits of surgical debridement in the presence of advancing cellulitis, crepitus, fluctuance, and/or sepsis secondary to pressure injury–related infection usually outweigh the risks. However, relative contraindications include anticoagulant therapy, bleeding disorders, and immune incompetence.

If the necrotic ulcer is on a limb, a thorough vascular assessment is conducted prior to debridement to rule out arterial insufficiency. The NPIAP recommends against debridement of stable, hard, dry eschar in ischemic limbs.

CONSERVATIVE SHARP DEBRIDEMENT

This technique uses scalpels, curettes, scissors, and forceps to remove clearly identifiable devitalized tissue above the level of viable tissue. This method removes necrotic tissue and decreases bacterial burden on the wound surface. It may be performed by specially trained, competent, qualified, and licensed healthcare professionals consistent with local, legal, and regulatory statutes.

Both surgical/sharp and conservative sharp debridement should only be performed in wound locations that have adequate blood flow to support the ability to heal. They are not performed on dry, stable eschar on ischemic limbs or in other areas where healing is not expected.

AUTOLYTIC DEBRIDEMENT

This method allows the body to break down necrotic tissue by using its own enzymes and defense mechanisms. Autolytic debridement is accomplished with the use of occlusive dressings
such as hydrocolloids and films. These dressings help maintain a moist wound environment, reduce pain, and provide a barrier to infections. The dressing is left on for a few days, allowing the accumulation of fluids and enzymes at the site. The dressing is removed, the wound cleansed, and a new dressing applied. This method is effective but takes time—which varies according to what is used and the wound’s response—usually about four weeks.

**ENZYMATIC DEBRIDEMENT**

This method involves the use of an enzyme debriding agent. This agent breaks down necrotic tissue without affecting viable tissue. The enzyme product is applied daily to the necrotic tissue and then covered by a moist dressing. Dry eschar is scored or crosshatched prior to the use of the enzyme so the enzyme can penetrate the eschar. Enzymes are by prescription only, and currently only one (Santyl) is available on the market. It cannot be used with any dressings containing heavy metal ions, specifically silver or iodine, as these will reduce the activity of the enzyme.

**LARVAL (MAGGOT) THERAPY**

This method uses sterilized bottlefly maggots, which debride the wound by dissolving dead and infected tissue with their digestive enzymes (in other words, the maggots eat the dead tissue). The maggots also disinfect the wound by killing bacteria. This in turn stimulates the growth of healthy tissue. It should not be used in the presence of active hemorrhage or bleeding disorders, exposed blood vessels, limb- or life-threatening infection, necrotic bones or tendons, inadequate perfusion for healing, wounds in deep cavities or sinus tracts, or rapidly advancing tissue necrosis (WOCN, 2016b). (See also “Resources” at the end of this course.)

**MECHANICAL DEBRIDEMENT**

Mechanical debridement utilizes physical forces to remove necrotic tissue. In the past, the most common type of mechanical debridement was the use of wet-to-dry dressings and whirlpools, but **wet-to-dry dressings are no longer recommended**. In this method, wet gauze is applied to the wound and necrotic tissue is allowed to dry and then forcibly removed without rewetting. The gauze will have stuck to the necrotic tissue, thus removing it when the gauze is removed. However, this method is nonselective in that healing tissue will also be removed, thus retraumatizing the wound bed and causing significant pain. The use of whirlpools has also fallen out of favor due to the difficulty in assuring that the equipment is free of pathogens before its use on the next patient.

Low-frequency ultrasound (ultrasonic mist) is increasingly being used to remove devitalized tissue. It has been found to reduce purulent drainage and assist with debridement. This requires trained clinicians and specialized equipment to administer.

**PULSATILE LAVAGE FOR WOUND CLEANING AND DEBRIDEMENT**

Pulsatile lavage is a good means of removing sizeable quantities of dead tissue from a wound. It is frequently recommended for wounds with extensive necrotic tissue when other means of debridement are not suitable. Once the wound is free from debris, this therapy is discontinued.
Pulsatile lavage equipment includes intermittent high-pressure lavage along with suction to loosen and remove necrotic tissue from the wound (WOCN, 2016a). As well as debriding the wound, the pulsatile activity may assist with the growth of granulation tissue (Ayello & Baranoski, 2016).

Pulsatile lavage therapy is done for 15 to 30 minutes, and for wounds with extensive necrotic tissue, it may be done twice a day. Patients may need to be premedicated for pain before starting the procedure. Clinicians performing pulsatile lavage must wear personal protective equipment, including eye and face protectors (Ayello & Baranoski, 2016).

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<thead>
<tr>
<th>COMPARISON OF DEBRIDEMENT TYPES</th>
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<tr>
<td>Type</td>
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<tr>
<td>Conservative sharp</td>
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<tr>
<td>Enzymatic (collagenase)</td>
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<tr>
<td>Autolytic</td>
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<tr>
<td>Larval/maggot</td>
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<tr>
<td>Pulsatile lavage</td>
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**BIOFILM**

Debridement of biofilm can also help a wound progress toward healing. Bacterial biofilms are extremely common in the natural environment. They are known to cause chronic inflammation that contributes to many diseases, including periodontal disease (the plaque on teeth), surgical device infections, urinary catheter infections, chronic ear infections, and contact lens–associated eye infections.

Biofilms are complex microbial communities containing multiple species of bacteria and fungi. These organisms produce and secrete a matrix that firmly attaches the film (and bacteria in it) to a surface. Studies show that biofilms are present in every 3 out of 5 chronic wounds.
This matrix protects the bacteria in it from antibodies and white blood cells and from antiseptics and disinfectants, making the repeated use of sharp or conservative sharp debridement the only effective way of removing them. Although a biofilm can reform within 4 to 24 hours, this time can help a wound start to heal.

Biofilms can be difficult to detect visually. Some studies have identified them as shiny, translucent, slimy layers on a wound bed that can be pale yellow or green. However, further studies are required to test the accuracy of this finding.

Suspicion of biofilm in a pressure injury should be high if an ulcer:

- Has been present for more than four weeks
- Lacks signs of any healing in the previous two weeks
- Displays clinical signs and symptoms of inflammation
- Does not respond to antimicrobial therapy

(Ayello & Baranoski, 2016; EPUAP/NPIAP/PPPIA, 2019)

**Dressings**

Wound dressings are a central component of pressure injury care since the appropriate selection and use of dressings can facilitate pressure injury healing. The selection of the dressing for the pressure injury is very important and based on many parameters, such as:

- Presence of infection or necrosis
- Size, depth, and presence of undermining or tunneling
- Location
- Type of tissue in wound bed
- Drainage/exudate
- Condition of the periwound skin and tissue
- Goals for healing
- Individual or caregiver needs, such as pain reduction or odor control
- Cost/reimbursement of the dressing
- Availability
- Ease of use

(WOCN, 2016b; EPUAP/NPIAP/PPPIA, 2019)

Maintaining a moist wound is a primary factor in dressing selection. It has been accepted that wound healing is optimized when the wound is kept in a moist environment rather than air-dried.
or dried with heat lamps or topically applied drying agents (WOCN, 2016a). If the pressure injury is draining a large amount, then a dressing that will absorb but not dry out the wound is needed. If the pressure injury has minimal drainage, then a dressing that replaces moisture and/or does not allow the ulcer to dry out is needed.

Dressings are also changed based on the amount of drainage. The dressing for a heavily draining wound is changed often, while that of a minimally draining wound can be changed less than daily.

The type of dressing required or indicated may change over time as the pressure injury heals or deteriorates. The wound must be monitored at every dressing change and regularly assessed to determine whether the type of dressing being used is appropriate or should be modified.

Manufacturer’s recommendations should be followed, especially related to frequency of dressing changes. The plan of care should guide dressing changes and wear times as well as contain plans for dressing changes as needed (for family, the patient, and staff) due to soilage, loosening, etc. All of the wound dressing product is to be completely removed with each dressing change.

It is important to note, however, that every time a dressing is removed and the wound cleansed, the temperature of the wound bed drops to room temperature. The body then must expend energy to bring the wound bed back to body temperature so that cell repair and growth can continue. This can take several hours. Less-frequent dressing changes aid the wound in healing by giving it time to do so.

**DRESSING TYPES**

Dressing selection is an essential part of wound care and one of the most challenging. There are an abundance of wound care dressings on the market. The major types of wound dressings and their appropriate use are discussed below. (See also the table “Summary of Dressing Types” at the end of this section.)

**Hydrocolloid**

Hydrocolloid dressings (e.g., Duoderm) are occlusive, wafer-type dressings made of gelatin materials combined with other products to create a self-adhesive dressing. Some also have a thin border of adhesive around the edge of the dressing. The hydrocolloid interacts with the wound drainage to form a gel, which allows it to come off the wound without damaging it. This gel can resemble purulent drainage, but it is not. (The clinician should assess the wound after cleansing to determine if the wound is infected; such a determination cannot be made according to drainage alone).

Because the dressing is occlusive, water vapor from perspiration cannot evaporate, and only small amounts of wound drainage can be absorbed, which causes leakage. Hydrocolloids are not used in infected wounds, since infected wounds have increased drainage. They are a good choice for shallow wounds with minimal drainage, such as stage 2 and shallow stage 3 pressure injuries.
They should only be used on body areas where they will not roll or melt. They can be used as cover dressings, with filler dressings used underneath deeper ulcers to fill dead space. They are also used for autolytic debridement because they maintain a moist wound environment that assists the body in removing dead tissue. They can prevent contamination of the wound from incontinence.

Hydrocolloid dressings are easy to apply and come in many shapes and sizes for different body areas. These dressings have strong adhesives and should not be used if the dressing needs to be changed more than three times per week. They should be removed carefully to reduce skin trauma.

**Transparent Films**

These dressings were originally designed to cover intact skin over IV sites. They cannot absorb drainage from a wound. They can be used to protect body areas at risk for friction injury and used to support autolytic debridement. They may be used as a secondary dressing to hold in other dressings and to protect a dressing from urine and stool. They should be removed carefully.

**Hydrogels**

Solid gel dressings and liquid (amorphous) gels are designed to hydrate the wound. The gels are applied directly to the wound or to another dressing first, such as gauze. A cover dressing is needed to help to retain the moisture, such as a hydrocolloid or a transparent dressing.

Solid or wafer-type gel dressings can absorb varying amounts of drainage and promote autolysis due to the moist environment they create. They also have a cooling effect, which can decrease pain. The moist environment promotes wound healing and can assist in autolytic debridement. Other advantages are reduced wound pain (since the gels do not adhere to the wound surface) and decreased dressing time and frequency.

Amorphous gels are best for ulcers located in areas where the dressing is likely to move or shift, such as on a lower leg. Sheet gels are best on ulcers on nonmoving body parts. Generally, these dressings are used on shallow, minimally draining ulcers.

**Alginates**

Alginate dressings, commonly referred to as calcium alginate or seaweed dressings, are able to absorb exudate and maintain ulcer bed moisture. They allow for nontraumatic removal. They can be left in a pressure injury for several days, decreasing the frequency of dressing changes; the frequency of dressing changes is usually one to three days. They are indicated for moderately to heavily draining pressure injuries only. If the pressure injury is heavily draining, the cover dressing used should be absorptive as well.
Alginates come in sheet or rope forms. The clinical choice between the sheet or rope forms is based on the depth and shape of the pressure injury. If the pressure injury is deep, alginate sheets should not be “stacked” to fill the pressure injury; this is unnecessarily expensive. In a pressure injury that is deep and draining heavily, the alginate is placed on the pressure injury bed and fluffed gauze is used as a secondary filler for additional absorption. They should not be used in tunnels.

Alginate fibers are not biodegradable and so must be completely removed from the pressure injury bed during cleaning. Because they have minimal antimicrobial properties, alginate dressings are generally not used as the primary or only treatment for infected pressure injuries. However, calcium alginate dressings with controlled-release ionic silver can be used on heavily draining infected pressure injuries for patients who are not allergic to silver.

**Hydrofiber**

These dressings are similar to alginate dressings but composed instead of carboxymethylcellulose. They are highly absorptive, and when exposed to drainage, they form a gel. They are available plain and with antimicrobials, in sheets or ropes. They are nonadherent and require a secondary dressing. Dressing change frequency depends on the amount of drainage and the ability of the secondary dressing to absorb, but typically ranges from one to three days. They can be used in stages 3 and 4 pressure injuries.

**Foam**

Foam dressings are most commonly made of polyurethane and contain small, open cells for absorbing exudate. How much they absorb depends on the specific dressing. They come in a variety of shapes and sizes, with and without antimicrobial agents, and in adhesive and nonadhesive types. They are used as both primary and secondary dressings and can be used on low- to heavily draining wounds. They can be used as primary dressings for draining stage 2 and shallow stage 3 injuries and as cover dressings for deeper stage 3 and 4 injuries.

Frequency of dressing changes depends on the amount of drainage and the absorptive capacity of the foam. They must be changed before they become soaked to prevent periwound maceration and bacterial invasion.

They are not appropriate for use on dry wounds or wounds with minimal drainage. They cannot promote autolysis of dry eschar.

**Gauze**

Gauze is a common dressing used for wound cleansing and as a wick, filler, or cover dressing. Gauze can be moistened with saline or an antiseptic agent and can be used for both clean and dirty wounds. It comes in a variety of forms, both plain and antimicrobial.
Nonwoven gauze should be used for dressings in a wound, since woven gauze has loose fibers that can become embedded in the wound and act as foreign bodies.

Gauze should be moistened before placing in the wound. It does not absorb well, dries quickly, and thus requires more frequent dressing changes. It is more likely to stick to the wound surface than other products, which can cause trauma when removed. It is best as a cover dressing, not a primary dressing. If gauze is all that is available, then nonwoven is best, moistened and fluffed into the wound bed to fill defects and dead space while avoiding over packing.

**Composite Dressings**

As the name suggests, these dressings are a combination of more than one type of product. They incorporate multiple functions in a single dressing. Composite dressings can include a layer of absorption or a bacterial barrier with the inclusion of foam, hydrocolloid, or hydrogel. Composite dressings can be either nonadherent or semiadherent. Composite dressings can be used either as a primary or secondary dressing.

Three important features to remember when using a composite dressing are:

1. Composite dressings are not to be cut, as this will decrease the functionality of the dressing.
2. The constituent in the center of the dressing is applied over or in direct contact with the wound bed.
3. When choosing a composite dressing, allow for at least one inch of dressing material that covers the intact skin around the wound.

(Ayello & Baranoski, 2016; Bryant & Nix, 2016)

**ANTIMICROBIAL DRESSINGS**

Impregnated dressings are an option for pressure injuries infected with multiple organisms because these dressings offer broad antimicrobial coverage, including essentially all known wound pathogens. They are available in various forms, including cream, ointment, powder, spray, and all forms of dressings. They vary in the duration of antimicrobial effectiveness, absorptive capacity, management of odor, and management of pain. Many of these advanced dressings do not need to be changed daily, which reduces pain, time, and expense. Manufacturer guidelines for use should be followed. Several types are described below:

**Silver-Impregnated**

Silver has proven antimicrobial activity against resistant bacteria such as methicillin-resistant *Staphylococcus aureus* (MRSA) and vancomycin-resistant *Enterococcus* (VRE). It is available as amorphous hydrogels, sheet hydrogels, alginates, hydrofibers, foams, contact layers, wound powders, ointments, and negative-pressure foams. These dressing may be considered for pressure injuries that are clinically infected, heavily colonized, or
at high risk for infection. They should be discontinued when the infection is controlled. Silver can turn tissues a dark color. It is contraindicated in patients allergic to silver. Some brand names are Acticoat, Aquacel Ag, Silvasorb, and Mepilex Ag.

**Silver Sulfadizine**

Silver sulfadizine (Silvadene) is a combination of silver and a sulfa antibiotic in a cream base. It has been used for decades in burn management because it is effective in preventing infection. However, it is rapidly inactivated in the wound, and thus frequent dressing changes are necessary to maintain therapeutic levels. Frequent dressing changes are time-consuming, expensive, and can be painful, which is why silver-impregnated dressings are more desirable.

**Honey-Impregnated**

Medical-grade honey is used for heavily contaminated or infected pressure injuries. It has antimicrobial effects against viruses, fungi, and over 50 species of bacteria, including *Pseudomonas aeruginosa*, *S. aureus*, MRSA, and VRE. Honey acts as an antimicrobial by creating an osmotic effect that dehydrates the bacteria and by producing hydrogen peroxide, which lowers the pH of the wound and inhibits bacterial growth. It contains antioxidants and releases anti-inflammatory products. It reduces odor as well. Medical-grade honey dressings are FDA approved and sterilized; it is not recommended that regular honey be used due to possible contaminants.

Honey-impregnated dressings come in several forms, including alginates, hydrocolloids, ropes, hydrogel sheets, and amorphous gels and pastes. The dressings can be left in place for several days depending on the amount of drainage, patient response, and soiling of secondary dressings. Some patients complain of a stinging or burning pain, which is usually temporary. They may be used in stages 2, 3, and 4 pressure injuries. They assist in debridement. They are contraindicated in patients allergic to honey. The most common brand name is MediHoney.

**Cadexomer Iodine**

As the product absorbs wound drainage, iodine is delivered by sustained released into the wound bed, maintaining a steady level of iodine that is toxic to bacteria but nontoxic to the “good cells” in the wound bed. It is available as an ointment, dressing, and powder. For the product to work best, it requires an adequate amount of drainage or moisture to release the iodine; thus, dry wounds will not activate the dressing. It is not for use in patients allergic to iodine, dyes, or shellfish; those with thyroid disease; those taking lithium; or women who are pregnant or breastfeeding. The risk of systemic absorption increases when iodine products are used on larger, deeper wounds or for prolonged periods. Common brand names are Iodoflex and Iodosorb.
**Impregnated Gauze**

A gauze dressing impregnated with polyhexamethylene biguanide (PHMB) provides a barrier to bacteria and inhibits the growth of bacteria in the dressing, thus protecting the wound and potential spread of bacteria from the wound. It should not be used in patients with reactions to PHMB or chlorhexidine. It should be moistened only with normal saline or water, since antiseptic solutions can inactivate it. It is most useful to prevent infection in a wound or for the critically colonized wound, rather than as a primary treatment for an active wound infection.

**Antiseptic Foam**

Hydrofera Blue is the most common brand name foam dressing containing methylene blue crystal and gentian violet, two antiseptics that have been used for over 50 years. They have bacteriostatic properties (prevent bacterial growth) against many bacteria, including MRSA. When rehydrated, the foam becomes soft and absorptive and traps bacteria in it. This must remain moist and is thus useful for packing draining wounds. Recently, the two antiseptics have been available in a foam that does not need rehydration and can be used over shallow wounds. It can also be used with the enzyme debriding agent Santyl to provide both antimicrobial and debriding ability for the wound.

**ANTISEPTIC SOLUTIONS**

The use of nontoxic topical antiseptics for pressure injury care can be considered for a limited time to control bacterial bioburden (the diversity, virulence, and interactions of organisms with each other and with the body). These are agents that destroy or inhibit the growth and development of bacteria on living tissue. Resistance to antiseptics can develop.

These products can be toxic to “good” cells and should be used for only a short period of time until the wound is clean and surrounding inflammation is reduced. However, if the risk of delayed wound healing due to infection is great, then the use of the antiseptics may override the risk of damage to healthy cells. The periwound skin area must be protected.

The most commonly used products are:

- **Povidone iodine**: Low cost and commonly available. It is bactericidal, but studies have shown it does not aid in wound healing. Only the solution should be used in wounds; the scrub form is mixed with detergent and used on intact skin only.

- **Sodium hypochlorite** (Dakin’s solution or Clorpactin): The active ingredient is dilute bleach. It is available in retail stores or formulated by a pharmacy if there is a specific dilution required. It is effective against most bacteria in a wound.
and significantly reduces wound odor. It may also help with debridement. Quarter-strength (0.125% sodium hypochlorite) is bactericidal and with reduced toxicity to healthy cells. (Full-strength Dakin’s is actually 0.5%; thus, half-strength is 0.25%, quarter-strength is 0.125%, etc.) It must be stored away from sunlight and out of the reach of children, since it is poisonous. It can be used for cleaning or as wound packing. Dressings are changed daily and should be discontinued when the wound is clean.

- **Acetic acid**: Dilute acetic acid may be of benefit in pressure injuries infected with *Pseudomonas aeruginosa*. It is not effective against any other pathogen. The most commonly used concentration is quarter-strength. It can be used as a wound cleanser or as a daily dressing and discontinued when the wound is clean. The periwound skin must be protected.

These products can also be used on “maintenance wounds,” which are wounds not expected to heal but for which control of the bacterial burden is desired.

### SUMMARY OF DRESSING TYPES

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<thead>
<tr>
<th>Name (Type)</th>
<th>Use(s)</th>
<th>Advantages</th>
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| **Alginates**
(absorbent, made from light seaweed) | In moderately to heavily draining wounds; for stages 3 and 4 | • Can stay in the wound for up to 72 hours  
• Flat and rope dressings available  
• Silver impregnated available |
| **Hydrocolloids**
(occlusive) | Shallow wounds with scant drainage, autolytic debridement; to protect periwound area from trauma and drainage; not appropriate for stage 3 or 4 | • Simple to apply  
• Wide range of sizes and shapes  
• Conformity to wounds on most parts of the body |
| **Hydrogels**
(hydrating; donate water to the wound bed) | In shallow wounds with scant drainage; for stage 2 and shallow stage 3 | • Cost effective  
• Easy to apply; helps with pain management  
• Can be used on donor sites  
• Promote autolytic debridement |
| **Hydrofiber**
(absorbent; made from carboxymethylcellulose) | In moderately to heavily draining wounds; for stages 3 and 4 | • Will not adhere to wound bed (unless allowed to dry out)  
• Available in plain and antimicrobial forms |
| Foam                  | In moderately to heavily draining wounds; to protect against shear injuries; primarily a cover dressing; stages 2, 3, and 4 | • Highly versatile; reduces wound pain  
  • Available with and without adhesive borders |
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<td>(absorbent, can be adhesive or nonadhesive)</td>
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| Antimicrobial         | Against a broad spectrum of microorganisms that cause wound infection and biofilm formation; stages 3 and 4; honey gel can also be used on stage 2 | • Help reduce wound odor  
  • Easily removed; decrease discomfort during dressing changes |
| (cadexomer iodine, silver, honey, hydrofera blue) |                                                                                                                            |                                                                                          |

**WHEN TO USE COMMON DRESSING TYPES**

**Example 1:** An elderly patient has a large stage 4 pressure injury on his sacral area. There is a large amount of necrotic tissue that requires surgical debridement. The wound is draining heavily and requires a dressing that will provide maximum absorption. The goal is to provide absorption of excessive drainage while at the same time maintaining a moist wound bed surface. A good choice for this wound would be either an alginate dressing or a hydrofiber dressing, with a cover dressing. Both of these dressing types provide excellent absorption for heavily draining wounds, which will also protect the periwound area from maceration. Since they do not require daily dressing changes, alginates can be left in the wound for up to 72 hours. Fewer dressing changes are also less painful and traumatic for the patient.

**Example 2:** A patient has a stage 3 pressure injury on his lower leg that is not healing. While assessing the wound, the clinician recognizes that the wound bed is too dry, which may be what is preventing the wound from healing. This pressure injury requires a dressing that will add moisture to the wound to promote an optimal healing environment. The clinician recommends amorphous gel applied directly to the wound bed, which will assist in hydrating the wound, covered with a layer of fluffed gauze and a secondary dressing. It is also important for the clinician to choose a moisture-retentive secondary dressing, with good options for this wound being a transparent adhesive dressing or a hydrocolloid dressing.

**Example 3:** An elderly female patient with contractures of her lower extremities has developed an unstageable pressure injury on the medial aspect of her left knee. The necrotic tissue is soft to the touch, and the healthcare provider decides it needs to be debrided. The patient is not a candidate for sharp debridement and will require an atraumatic form of debridement. The clinician recommends autolytic debridement using a hydrocolloid dressing with a thin adhesive border. The components of the hydrocolloid dressing will interact with the wound drainage to form a gel, which results in the removal of necrotic tissue from the wound bed. Frequency of dressing change will depend on the amount of drainage, but these dressings can be left in place for 3 to 7 days.
Example 4: A patient with limited mobility and breathing problems requires the head of the bed elevated at all times. Having to maintain this position puts the patient at increased risk for friction- and shear-related pressure injury. She has a stage 2 pressure injury on her coccyx. To promote healing and prevent further injury, the clinician recommends the application of a foam dressing with an adhesive border. The clinician will monitor the dressing frequently to ensure that the edges are not rolling.

Example 5: A right ischial stage 4 pressure injury has a large amount of drainage with a malodor and is showing no signs of healing. The wound care team recognizes that the wound is infected and would benefit from antimicrobial treatment. In order to determine the most appropriate dressing, the clinician reviews the patient’s overall history and finds the patient is allergic to silver and shellfish. The silver allergy rules out the use of a silver dressing, and the shellfish allergy is a contraindication to the use of iodine. The clinician therefore recommends using a medical grade honey dressing and reevaluating the wound healing progress in two weeks.

Adjunctive Wound Care Therapies

Adjunctive wound therapies are treatments that are used when wounds fail to heal using standard wound care. However, there are only a few recommended specifically in the treatment of pressure injuries. These include negative-pressure wound therapy (NPWT), biophysical agents, and recombinant platelet-derived growth factor (PDGF).

NEGATIVE-PRESSURE WOUND THERAPY

Negative-pressure wound therapy (also called vacuum-assisted closure devices or sub-atmospheric-pressure dressings) utilizes devices that can greatly assist pressure injury wound healing. NPWT has as its greatest benefit the reduction of wound volume. NPWT promotes wound healing through removal of third-space edema, which improves nutrient and oxygen delivery, removal of wound drainage that would otherwise promote bacterial growth, and the promotion of granulation tissue.

There are several types of NPWT systems; all systems are based on either foam or gauze dressings. Whichever type is used, the dressing is fitted into the wound and covered by a special plastic film. A suction tube is applied through a hole made in the film and connected to the sponge or gauze via a disc. When the NPWT unit is turned on, a vacuum is applied to the tube, and it continuously sucks fluid from the wound. The vacuum also pulls the plastic film tightly over the top of the wound, sealing the wound from the environment, protecting the wound from outside contaminants, and keeping the wound warm.

NPWT is recommended for deep stage 3 and 4 pressure injuries. The wound bed must first be debrided of necrotic tissue. It cannot be used in malignant wounds, where vital organs or vessels are exposed, in dry wounds, or in patients with untreated infections. Not every pressure injury or every patient is a candidate for NPWT. A wound bed that is friable (bleeds easily) with weak
tissue may not be able to handle the suction placed on it by the equipment and may break down further. The location of the pressure injury might make it very difficult to maintain a seal.

If tunneling is present, the wound is packed loosely with white foam (if a foam system is being used). This hydrophilic foam does not fall apart easily, reducing the possibility of unintentionally leaving a piece of foam in the area of tunneling.

NPWT dressings are usually changed every 48 to 72 hours and sometimes more frequently for heavily infected wounds or heavily exudating wounds, depending on physician orders. NPWT is continued as long as there is evidence of wound healing (i.e., the growth of new, healthy granulation tissue and decreasing wound size). Once a healing wound has filled in with granulation tissue close to surface level, NPWT is discontinued.

As with any other type of wound care treatment, ongoing assessment must be made to be sure that the wound is progressing toward healing. Wounds treated with NPWT are no different. As always, manufacturer guidelines should be followed.

**Special Considerations**

When using NPWT, some special considerations must be kept in mind:

- Painful dressing changes can be prevented by placing a contact layer next to the wound bed beneath foam dressings (with prior physician/surgeon approval). If foam is adherent to the wound bed, it can be soaked with normal saline for a few minutes prior to removal, allowing it to be removed more easily. As well as decreasing pain, both these measures reduce the likelihood of causing wound bleeding.

- Special care is taken to protect the periwound area. This can be done using spray-on skin sealants or “picture-framing” the wound edges with strips of hydrocolloid dressings.

Most NPWT devices have two settings: continuous suction or intermittent suction. Continuous suction is recommended at the beginning of therapy, and it is also the most appropriate setting for heavily draining wounds. Intermittent suction is usually applied when the amount of drainage has decreased and the goal is to enhance the growth of granulation tissue. However, some patients complain of wound discomfort with intermittent therapy (Bryant & Nix, 2016).

NPWT can be safely used in children older than one year (Wong et al., 2016). In the pediatric population the pressure setting should be modified and the therapy closely monitored by the wound clinician.
Negative-pressure wound therapy, with foam dressing, plastic film, and suction tube. (Source: Shortcut27 [CC BY-SA 3.0 (http://creativecommons.org/licenses/by-sa/3.0/)].)

BIOPHYSICAL AGENTS

The biophysical agents recommended by NPIAP are:

- Electrical stimulation
- Electromagnetic agents
- Pulsed radio frequency energy
- Ultraviolet light therapy
- Pulsatile lavage for wound cleaning and debridement

**Electrical Stimulation (E-Stim)**

Studies have shown that E-stim can result in significant wound healing. It is particularly useful as a treatment for wounds that have stalled in the healing process. Electrical stimulation has demonstrated several positive findings, including increased blood circulation to the wound, increase in the number of neutrophils in the wound drainage, and an increase in fibroblasts and collagen synthesis (Bryant & Nix, 2016).

Electrical stimulation therapy is applied by physical therapists via specialized electrodes that employ an electrical current to transmit energy to the tissues. The length of treatment is normally 45 to 60 minutes, with five to seven treatments each week. The following precautions are important when considering electrical stimulation as a treatment option:

- It should not be used in wounds where there is a possibility of basal or squamous cell carcinoma.
- It should not be used in the presence of osteomyelitis.
• It should not be used in patients with electrical implants (e.g., pacemakers).
• If the wound is being treated with iodine or sliver products, these must be completely removed from the wound bed before applying electrical stimulation therapy.
  (Bryant & Nix, 2016; Ayello & Baranoski, 2016)

**Electromagnetic Agents**

This therapy uses an electromagnet to produce an electrical current to enhance wound healing. Electromagnetic fields are applied to the wound area. This treatment is also referred to as *pulsed electromagnetic induction*.

A Cochrane review in 2015 found there was no “strong evidence” to indicate that electromagnetic therapy was beneficial in healing pressure injuries. However, the authors pointed out that since there were only two participants in the study, further studies are needed to determine if electromagnetic therapy helps or hinders wound healing.

**Pulsed Radio Frequency Energy**

A pattern of low-flow electrical current is used to stimulate wound healing. Electrodes are positioned on the tissue and provide a sequence of pulses. There is a short gap between each pulse when there is no current flowing. Treatments are completed for one hour on 5 to 7 days each week, and are continued for as long as the wound is improving.

The difficulties with using any of the above forms of therapy in wound care include a lack of agreement in the wound healing community regarding the strength of evidence concerning the usefulness of the therapies in wound healing, reimbursement issues, and the lack of trained clinicians who are able to perform the therapies (Bryant & Nix, 2016).

**Ultraviolet Light Therapy**

A study conducted in 2008 advised against the use of ultraviolet light in the treatment of pressure injuries. However, the consortium that formulated the 2014 International Guideline for Pressure Injury Treatment, with included the NPIAP, recommended it in the short-term treatment of pressure injury (Bryant & Nix, 2016). More recent research indicates ultraviolet light treatment has the ability to reduce wound bio-burden and promote wound healing. It is effective against MRSA (Ayello & Baranoski, 2016).

Ultraviolet light therapy is usually performed by physical therapists.

A frequently used procedure for administrating this therapy includes:

• Applying petrolatum to the periwound tissue
• Covering the surrounding areas with a towel or a sheet to protect against UV absorption
• Placing therapy equipment perpendicular to the skin and about one inch from the wound (newer UV therapy equipment usually has distance guards, which promotes accurate distance and accuracy of consecutive treatments)

Therapy is applied directly over the wound, with no intervening materials or substances between the wound bed and the therapy equipment.

In the past, therapy sessions lasted for 90 to 120 seconds, but current research postulates a shorter therapy time maybe more beneficial. During therapy the patient and clinician both wear UV-blocking eye protection (Bryant & Nix, 2016; Ayello & Baranoski, 2016).

RECOMBINANT PLATELET-DERIVED GROWTH FACTOR

Recombinant platelet-derived growth factors (PDGF) (becaplermin gel, brand name Regranex) play a role in regulating cell growth and division. This treatment can be considered for stages 3 and 4 pressure injuries that have delayed healing. PDGF has not been approved by the FDA for use in pressure injuries (Nix, 2016); however, it has previously been recommended for consideration in the treatment of pressure injuries by NPIAP (NPUAP/EPUAP/PPPIA, 2014) and WOCN (2016a).

PLASMA USE IN WOUND HEALING

Research in the use of platelet-rich plasma in the treatment of pressure injury is ongoing. A recent study has demonstrated a significant increase in the healing rates of stage 3 and stage 4 pressure injury healing when platelet-rich plasma was used. During this study, autologous-concentrated plasma was applied directly to the wound bed and covered with a transparent, non-adherent dressing. Further studies are needed to validate the usefulness of platelet-rich plasma in pressure injury care, to standardize treatment, and to determine the best method of application (Volalakis, 2019).

TREATMENTS NOT RECOMMENDED BY NPIAP

The following adjunct interventions are not recommended by NPIAP due to insufficient evidence of effectiveness in pressure injury treatment:

• Any other growth factors other than recombinant platelet-derived growth factor
• Bioengineered skin substitutes
• Infrared therapy
• Laser therapy
• Ultrasound
• Whirlpool
Vibration therapy
• Topical oxygen therapy
• Hyperbaric oxygen therapy

(A discussion of these modalities is beyond the scope of this course.)

Surgical Intervention

Stages 3 and 4 pressure injuries are often difficult to heal using conventional wound healing techniques. When a pressure injury does not respond to traditional management—including debridement, infection management, and advanced wound dressings—then surgical management may be considered (NPIAP, 2016a; EPUAP/NPIAP/PPPIA, 2019). However, surgical reconstructive options may be limited due to a shortage of available tissue to use for a flap and/or impaired blood flow to the area.

Prior to surgery the patient should be in an optimal state both mentally and physically, and factors that impair healing should be minimized. The patient’s ability to tolerate the surgery and participate in the postoperative rehabilitation must be assessed prior to any surgery. Some patients may not be surgical candidates due to malnutrition, immobility, poor compliance with treatment, or chronic diseases.

Operative procedures may include skin grafts or flaps (surgical reconstruction). Myocutaneous flaps (which include both skin and muscle) are the treatment of choice for full-thickness pressure injury because they provide good protection and blood supply to the area. Immediately after surgery, the operated region must be totally and completely offloaded using a support surface that provides a high level of pressure redistribution, shear reduction, and microclimate control, with ongoing repositioning. Many hospitals use an air-fluidized support surface postoperatively. Once the surgical incision has healed, the patient will be allowed to gradually apply pressure to the area.

Surgery is a last resort due to high rates of surgical complications and pressure injury recurrence. Dehiscence of the suture line is the most common complication after surgery, ranging from 11% to 38% (WOCN, 2016). Osteomyelitis affects up to 32% of patients with pressure injuries and is the major cause of breakdown after surgery (WOCN, 2016a; EPUAP/NPIAP/PPPIA, 2019).

FLAP RECONSTRUCTION SURGERY STUDY RESULTS

A large retrospective study of flap reconstruction surgery for sacral, ischial, and trochanter pressure injuries in spinal cord injury patients at Vanderbilt University Medical Center looked at patient-specific and possible modifiable risk factors related to complications that can develop post surgery. The major complications after flap surgery included wound dehiscence and repetition of the pressure injury as great as 80%.
Findings from the study demonstrated the following:

- **Age**: The average age of patients who had a recurrence of pressure injury was considerably younger than those of patients who did not have a repetition of pressure injury.

- **Race**: African American patients had a higher incidence of pressure injury reoccurrence when compared to other racial groups.

- **Location of pressure injury**: The presence of an ischial pressure injury was an independent risk factor for wound dehiscence and pressure injury repetition.

- **Flap choice**: Flaps under higher tension had a greater risk for wound dehiscence.

- **Smoking**: Smoking was identified as an independent risk factor for pressure injury repetition.

- **Diabetes**: Diabetes was an independent risk factor for flap infection but not an independent risk factor for pressure injury repetition.

- **Perioperative blood transfusions**: Perioperative blood transfusions were linked to postoperative complications, including flap infection, wound dehiscence, and pressure injury repletion.

- **Wound complexity**: Larger wounds and prolonged operative periods resulted in greater incidence of flap infection, and extended operative times were related to a greater incidence of wound dehiscence.

  (Bamba et al., 2017)

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**HEALING ASSESSMENT AND DOCUMENTATION**

Pressure injuries are assessed initially and reassessed at least weekly, with careful documentation of the findings. Minimally, wound care assessment and documentation include:

- Wound measurements (length, width, depth)
- Presence or absence of tunneling and undermining and its exact location (e.g., “undermining present from 9 o’clock to 11 o’clock to a depth of three centimeters”)
- Amount of drainage present (large, moderate, scant), its color, and presence of an odor (e.g., “a moderate amount of serosanguinous drainage, no odor noted”)
- Condition of the periwound area (e.g., “periwound tissue is dry and intact with a small 2-cm area of redness at the distal end of the wound)
- Patient’s response to any dressing change
- Whether pain medication was administered prior to the procedure
With each dressing change, the injury is also observed for anything that may indicate the need for a change in treatment (e.g., improvement or deterioration, more or less drainage, signs of infection, or other complications). Any signs of deterioration should be addressed immediately. The type of dressing may need to be changed based on this assessment (e.g., to an antimicrobial dressing or a more absorptive dressing) and/or a change made in frequency of wound care.

**Signs and Factors in Wound Healing**

General signs of healing are decreased size, less exudate, and tissue changes from devitalized tissues (slough and eschar) to granulation tissue and epithelialization.

- Stage 1 and 2 pressure injuries should show evidence of healing within one to two weeks.
- Stage 3 and 4 pressure injuries should show evidence of healing within two to four weeks.
- Large, deep, infected pressure injuries and those with large amounts of drainage and/or covered with slough or eschar are significantly less likely to heal within even three months, and some may not be fully healed even after five or six months of treatment. (WOCN, 2016a, EPUAP/NPIAP/PPPIA, 2019)

If after two weeks of treatment there has been no healing or signs of improvement, then all the risk factors are reevaluated and the plan of care revised to reflect new interventions.

In the case of a nonhealing pressure injury—and after the choice of wound care has been evaluated as appropriate and pressure is being relieved—then the patient is reassessed for other reasons why the injury is not improving. One systematic approach to determining what other factors might be affecting wound healing utilizes the acronym **DIDN’T HEAL**. Using this acronym and correcting those factors that can be corrected will aid in healing the injury. If factors cannot be corrected, healing the injury may not be possible.
<table>
<thead>
<tr>
<th><strong>“DIDN’T HEAL”</strong></th>
<th><strong>Description</strong></th>
<th><strong>Additional Factors</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>D</strong></td>
<td>Diabetes</td>
<td>Lack of diabetic control, causing diminished cardiac output, poor peripheral perfusion, and a decrease in the ability of WBCs to function</td>
</tr>
</tbody>
</table>
|   |   | • Fasting blood sugar >80–120 mg/dl  
|   |   | • A1C >6.5% |
| **I** | Infection | Increased destruction of collagen needed for repair |
|   |   | • Overwhelms body defenses |
| **D** | Drugs | Possible impaired collagen synthesis |
|   |   | • Steroids  
|   |   | • Chemotherapy (high risk for infection/malnutrition)  
|   |   | • Immunosuppressants (interfere with healing) |
| **N** | Nutrition | Deficiencies impairing normal wound healing |
|   |   | • Diet lacks adequate calories, protein, vitamins  
|   |   | • Obese patients not necessarily well-nourished |
| **T** | Tissue necrosis | Lack of oxygen impairing healing |
|   |   | • Cell death as a result of all the factors |
| **H** | Hypoxia | Inadequate tissue oxygenation impairing healing |
|   |   | • O₂ saturation <92%  
|   |   | • Anemia  
|   |   | • Poor circulation  
|   |   | • Comorbid conditions such as heart failure, pneumonia, CVA  
|   |   | • Pain |
| **E** | Excessive tension | Tension on wound edges leading to local tissue ischemia and necrosis |
|   |   | • When the patient is moved, wound is pulled |
| **A** | Another wound | Competition for factors needed for wound healing, impairing wound healing at all sites |
|   |   | • Increased nutritional needs |
| **L** | Low temperature | Decreases oxygen to the wound |
|   |   | • Poor circulation  
|   |   | • Use of cold cleansing solutions  
|   |   | • Frequent dressing changes that cause wound temperature to drop to room temperature |

(Daley, 2018)
CASE

James, a 29-year-old male patient who is paraplegic, arrived to the emergency department because of a recurrent stage 4 pressure injury at his left ischium. The patient states that his pressure injury returned because his wheelchair support cushion malfunctioned and the resulting pressure reopened the injury at the site of the scar tissue. James underwent surgery to the same area five years ago, which promoted healing of the previous injury through removal of infected bone and a flap-graft surgical reconstruction.

The size of the reopened wound is extensive, and the amount of drainage saturates a large, thick dressing in 12 hours. There is no necrotic tissue, but the patient’s bone is visible. Due to sepsis, James is admitted to the hospital. The infectious disease physician prescribes IV antibiotics for probable osteomyelitis. A surgical consult suggests possible surgery to the area again to close the wound, but not until the infection is cleared and the patient’s nutritional status is optimized.

To manage the drainage and protect the wound, a negative-pressure wound therapy dressing system is applied per protocol. The dietitian assesses James and recommends improvements to his nutritional status, particularly his protein intake. After a week in the hospital, James is discharged with home healthcare for six weeks of IV antibiotics and negative-pressure wound therapy. Referrals are made to the social worker for resources, the physical therapist for an appropriate wheelchair cushion recommendation and functional mobility evaluation, the occupational therapist to assess the patient’s self-care skills at home, and the dietitian for continued recommendations. A low-air-loss mattress is obtained to reduce pressure while he is in bed.

The physical therapist visits James at home to evaluate his mobility. The patient is able to move himself in bed and to safely transfer himself from the bed to a chair.

The occupational therapist also visits James at home, completes an evaluation, and identifies that he is independent with his activities of daily living. The occupational therapist observes James’s abilities for meal preparation and suggests modified utensils and a long-handled reacher that will make it easier for James to prepare meals.

The home health nurse visits James three times per week to change his wound dressing, draw labs, change the IV dressing, and assess his adherence to self-administering the IV antibiotics. The home health dietitian finds a source for an affordable protein supplement for James’s loss of protein from his wound drainage.

Healing Assessment Tools

There are several tools for assessing pressure injury healing. The Bates-Jensen Wound Assessment Tool (BWAT) is comprised of 15 items, of which 13 are scored from 1 to 5. The total scores and dates of assessment can be plotted on a graph, which provides an index of improvement or deterioration of the wound.
The **PUSH** tool (Pressure Ulcer Scale for Healing) was developed by NPIAP. A pressure injury is categorized using numerical scores of 0 to 5 according to surface area (length multiplied by width), drainage amount, and tissue type. A comparison of the total scores measured over time provides an indication of improvement or deterioration in the injury.

The **Spinal Cord Impairment Pressure Ulcer Monitoring Tool** (SCI-PUMT) was developed to assess pressure injury healing in patients with spinal cord injury. Pressure injury healing is defined as the reduction in volume of the pressure injury and complete healing as resurfacing of the wound. Volume is an estimate obtained by multiplying length by width by depth (WOCN, 2016a).

Many computer systems also have programs to monitor pressure injury progress. Of course, the clinician will also use clinical judgment to assess signs of healing, such as a decrease in the amount of drainage, pain, and wound size and an improvement in wound bed tissue. The clinician can also use photography, comparing baseline and serial photographs to monitor healing over time. Follow facility policy on the use of photography (see “Photography” below).

(See also “Resources” at the end of this course.)

**Documenting the Healing Process**

Wound care documentation includes a variety of information that reflects the wound status while it heals. Providing an accurate description of the skin and wound characteristics is critical following each dressing change. These findings of the pressure injury’s current status will help the clinician in revising the plan of care and treatment strategies over time.

The very basics of documentation are to document what was observed, what was done (including education provided), and how the patient responded. Documentation of pressure injury management includes an assessment of the pressure injury on admission, with each dressing change, on transfer, at discharge, or when a change in condition occurs (and per agency regulations) for any signs of skin and/or wound improvement or deterioration. Documentation also includes risk assessment and patient/family education provided. The skin under and around medical devices in particular is assessed for injury twice a day or more often if patient is prone to edema.

The following parameters are documented:

- At admission, onset, course, and duration of the pressure injury
- Description of the pressure injury
- Pain (location, intensity, quality, onset, duration, alleviating/aggravating factors)
- Patient/caregiver’s ability and willingness to adhere to the prevention and treatment program
• Prevention interventions that were initiated (referrals to dietary, physical therapy, occupational therapy, support surface management, skin care management, etc.)

• Discussions conducted with and observations made by physicians

The following elements are documented in any wound assessment (WOCN, 2016b; EPUAP/NPIAP/PPPIA, 2019):

**ANATOMIC LOCATION**

The anatomic location of the pressure injury is identified using proper terminology in documentation. (Terms such as anterior-posterior, medial-lateral, or proximal-distal can clarify location.) Anatomical drawings or photography may be used.

**STAGING**

The stage of the pressure injury is determined and documented. (See “Staging Pressure Injuries” earlier in this course.)

**DRAINAGE/EXUDATE**

Color, type, consistency, and amount are identified and documented. **Amount** may be indicated as: none, light/scant, moderate, heavy/large, or copious. **Color** may be indicated as serous (clear, watery plasma); sanguineous (bloody); serosanguineous (plasma and red blood); or purulent (thick, odorous, possibly yellow, green, or brown).

**ODOR**

Odor defines the presence or absence of high bacteria counts in the pressure injury and should be assessed only after cleaning the wound. Almost all drainage has an odor. A strong or foul odor from the wound bed suggests infection. A mild odor may be due to the particular wound care products in use.

**DESCRIPTION OF WOUND EDGES**

Wound edges may be documented as:

- **Attached**: Edges are attached, moist, and flush with the wound base (see wound images earlier in this course).

- **Unattached/rolled**: Undermining is present between the dermis and subcutaneous tissues. The edge of the wound is raised and a lighter color than the surrounding tissue.

- **Undermined**: There is a gap in the edge of the tissue that creates a lip or overhang of the edge.
DESCRIPTION OF THE PERIWOUND SKIN

Periwound skin is observed at least 4 cm around the wound. The periwound skin should be intact. It is documented as to the following qualities:

- **Color:** There may be redness, pallor, blanchable erythema, nonblanchable erythema, or purple discoloration.
- **Temperature:** Warmth may indicate further tissue breakdown or underlying infection.
- **Induration:** Abnormal firmness with a definite margin may indicate infection.
- **Maceration:** Softening of tissues may be due to soaking from wound drainage or contact with urine and/or stool.
- **Denuded:** Superficial skin loss may be due to drainage or trauma (such as from tape). *Excoriation* refers to linear, scratch-like marks, not to skin loss from trauma or incontinence.

TYPE OF TISSUE EXPOSED (APPEARANCE OF WOUND BED)

- **Red:** This may indicate clean, healthy granulation tissue. Granulation is a pink or red moist tissue composed of new blood vessels and connective tissue that fills an open wound when it starts to heal. It usually has an irregular, granular surface, like velvet. Not all red tissue is granulation.
- **Yellow:** This may indicate the presence of drainage or slough. Slough is a soft, moist, avascular (lacking blood supply) tissue that may be yellow, white, tan, or green. It may be loosely or firmly attached. It sometimes resembles chicken fat. Not all yellow tissue is avascular; it could be fibrous.
- **Black:** This may indicate the presence of eschar or necrotic tissue, which slows healing and allows bacteria to grow. It may be brown or tan and can be hard or soft or loosely or firmly attached. It can resemble a scab, but there is no healing occurring under it.

(See “Staging Pressure Injuries” earlier in this course for images of types of exposed tissue.)

WOUND MEASUREMENTS

Measurements are done at least weekly and following debridement. It is not necessary to document measurements with each dressing change, as changes in wound size do not occur that rapidly.

Measurements are taken using a single-use, metric tape measure; “coins” (dime-sized, quarter-sized, etc.) are not used.Descriptors such as round, oval, irregular, etc., are also useful. If possible, the patient is in the same position each time the wound is measured to promote...
consistency of measurements. Communication of the wound size is useful for other members of the healthcare team, regulatory agencies, and payers to determine progress.

- **Length:** Linear distances are taken from wound edge to wound edge and measured consistently over time. One method is to look at the wound as if it were a clock face: the top of the wound (12 o’clock) is toward the patient’s head. The bottom of the wound (6 o’clock) is toward the patient’s feet. Length is the longest distance measured from head to toe, or 12 o’clock to 6 o’clock.

- **Width:** Width is longest distance measured from side to side, perpendicular to the length, or from 9 o’clock to 3 o’clock.

- **Depth:** This is the distance from the visible surface to the deepest point in the wound base. Depth can be measured using a cotton-tip applicator, holding it perpendicular to the wound edge, placing the finger at the point on the swab that corresponds to the wound edge. The swab is then removed, with the distance on the swab measured on the tape measure.

- **Undermining:** A cotton-tip applicator is used to probe to the deepest part of the undermining, marking the depth between the end of the applicator and the wound edge with the finger and measuring it against the tape measure. The location of the undermining can be indicated using the clock face (e.g., “undermining extends from 12 o’clock to 5 o’clock and is deepest at 3 o’clock at 3 cm”).

- **Tunneling or sinus tract:** The tract is measured as for undermining and its location described using the clock-face method.

**PHOTOGRAPHY**

Some healthcare facilities use baseline and serial photographs as a method of monitoring pressure injury progress over time and evaluating the effectiveness of the current wound care. Photographs do not replace bedside assessment but may be useful for documentation. Techniques and equipment must be standardized and staff trained in taking the types of photographs required to ensure an accurate representation of the condition of the pressure injury so it can be reliably compared over time (Ayello & Baranoski, 2016).

The frequency of photos depends on individual facility policies, but at a minimum, photos are taken the first time the wound is assessed, once healing has occurred, and when the patient is transferred to another care setting. Some facility policies require weekly wound photography.

Prior patient consent is required for wound photography, and the use and confidentiality of the photos must be thoroughly explained to the patient. A written facility policy on wound photography will address:

- Patient consent (including a form)
- Frequency of photography
• Staff authorized to take wound photos

• Methods of identifying the patient, for example, placing the patient’s initials, medical record number, date, and time on a measuring guide placed proximal to the wound and included in the photo

• Storage of the photos in the patient’s records and who will have access to them (Nix, 2016; EPUAP/NPIAP/PPPIA, 2019)

CASE

After a few weeks of appropriate treatment, Mrs. Olivera, a patient with a pressure injury, remains in the hospital. The nurse manager reviews the nursing documentation, specifically the patient’s weekly wound measurements, for evidence that the wound is healing. The nurse manager detects a large variance between the patient’s wound measurements. On admission, Mrs. Olivera’s wound measured 4 cm x 6 cm x 3 cm (length x width x depth). A week later, the patient’s wound was documented to measure 1.5 x 2.5 x 1 cm, indicating the wound had decreased in size dramatically. The third week the wound was documented as 5.5 x 3.5 x 2.5 cm, indicating that the wound had worsened dramatically.

Such changes don’t make sense to the nurse manager. In questioning the staff about these measurement differences, the nurse manager discovers that for the second week’s measurements, the nurse reversed the measuring device and measured in inches rather than centimeters. For the third week, another nurse documented the width as the length and the length as the width.

At the next staff meeting, the nurse manager brings a wound model so that the nurses can practice wound measurement. The manager reviews that length is a head-to-toe or 12 o’clock–to–6 o’clock measurement, and that width is a side-to-side or 9 o’clock–to–3 o’clock measurement. She also emphasizes the need to use metric measurements. As a result, Mrs. Olivera’s wound is now consistently measured, demonstrating that the facility’s care of the patient is helping to heal the wound.

POTENTIAL COMPLICATIONS ASSOCIATED WITH PRESSURE INJURIES

• Heterotopic bone formation (presence of bone in soft tissue where bone does not normally exist)

• Fistula

• Abscess

• Osteomyelitis

• Bacteremia/sepsis
• Cellulitis
• Squamous cell carcinoma (Marjolin’s ulcer, an chronic ulcer that undergoes malignant transformation)
• Significantly higher risk for postoperative septicemia, pneumonia, stroke, urinary tract infection, and acute renal failure
• Higher risk of postoperative mortality in patients who have a pressure injury preoperatively

Minimizing the Recurrence of Ulcers

Achieving a closed wound is just the beginning of the effort to prevent a pressure injury from recurring. Clinicians must emphasize and reemphasize to patients and caregivers that measures to promote healing and prevent recurrence are lifelong. Recurrence rates for adults have been reported as high as 56%, and 21% develop a new injury at a different site (WOCN, 2016a). Patients with spinal cord injury have a pressure injury rate of 17% to 33% but have a recurrence rate from 31% to 79%.

The most common factors associated with recurrence are related to a lack of compliance with offloading the pressure area and maintaining a healthy lifestyle, such as stopping smoking, maintaining a normal weight, and controlling blood sugars if diabetic. Psychosocial problems (e.g., unemployment, low level of education, drug or alcohol abuse) have also been reported to increase the risk for pressure injury recurrence.

Clinicians must initiate and continue preventive education wherever an at-risk patient enters the healthcare system using interactive, individualized patient education. Telemedicine technology can be used to assess and teach patients who cannot easily come to a clinic or office.

Clinicians teach the following preventive measures to patients and caregivers:

• Perform a regular inspection of the skin, especially over bony prominences, using a mirror or even cell phones or digital cameras if necessary, to identify signs of pressure as evidenced by changes in the skin:
  o Color, such as a reddish or purplish hue
  o Temperature (warmer or cooler) compared to the surrounding skin
  o Texture, such as bogginess or induration

• If skin changes are present, offload pressure to the area and recheck in 15 minutes; continue to monitor the skin until the skin change resolves, and notify a healthcare professional if it does not resolve.

• Follow appropriate skin care regimens:
  o Keep the skin clean and dry.
- Use a mild soap and warm (not hot) water.
- Apply skin moisturizers such as petrolatum after bathing and when the skin is dry.

- For bed- and chair-bound patients:
  - Use measures to reduce friction/shearing, such as lifting instead of dragging across the bed, and/or wearing clothing such as long-sleeved pajamas and socks.
  - Routinely turn, reposition, and use pressure-redistributing devices if confined to a bed and/or chair.
  - Avoid the use of rings, foam cut outs, or donut-type devices.

- Maintain adequate nutrition and fluid intake; monitor for weight loss, poor appetite, or gastrointestinal changes that interfere with eating; and promptly report changes in health and nutritional problems to healthcare providers.
  (WOCN, 2016a; EPUAP/NPIAP/PPPIA, 2019)

### AVOIDABLE VS. UNAVOIDABLE PRESSURE INJURIES

Pressure injuries are a global health concern because, for the most part, they are a costly, preventable complication. But are all pressure injuries preventable or avoidable? In the past, clinicians have argued that pressure injuries are not avoidable when the patient is too sick to be turned; when there are more vital organs to worry about than the skin; or when it is too difficult, expensive, or there is not enough staff to implement all preventive measures.

Yet as early as 2000, the U.S. Department of Health and Human Services stated that reducing pressure injury incidence is an objective for all healthcare providers. In 2008, the Centers for Medicare and Medicaid Services (CMS) determined that hospital-acquired conditions could be reasonably prevented with evidence-based guidelines. In support of this determination, CMS stopped reimbursing hospitals for the treatment and care of pressure injuries that were not present on admission.

In 2014, NPIAP (then NPUAP) held a consensus conference on avoidable vs. unavoidable pressure injuries. The following is a summary of the consensus reached:

- Most pressure injuries are avoidable.
- Not all pressure injuries are avoidable.
- There are situations that render pressure injury development unavoidable, including hemodynamic instability that is worsened with physical movement and inability to maintain nutrition and hydration status and the presence of an advance directive prohibiting artificial nutrition/hydration.
- Pressure redistribution surfaces cannot replace turning and repositioning.
• If enough pressure is removed from the external body, the skin cannot always survive.

The definition of avoidable vs. unavoidable pressure injuries was revised to state that:

• An **avoidable pressure injury** is one that can develop when the provider did not do one or more of the following:
  - Evaluate the patient’s clinical condition and pressure injury risk factors
  - Define and implement interventions consistent with patient needs, patient goals, and recognized standards of practice
  - Monitor and evaluate the impact of the interventions
  - Revise the interventions as appropriate

• An **unavoidable pressure injury** can develop even when a [healthcare] provider does all of the above. Not all pressure injuries are avoidable, because there are patient situations where pressure cannot be relieved and perfusion cannot be improved.

• However, the determination regarding avoidability is made after the fact, when the processes of care can be evaluated. It cannot be predetermined that an unavoidable pressure injury will develop.

Consensus was also reached on the following **clinical issues**:

• There are some patients in whom pressure injury development is unavoidable. Conditions were identified that may lead to unavoidable pressure injuries (e.g., hemodynamic instability and impaired perfusion); however, these conditions do not make pressure injuries inevitable. The duty to provide care remains.

• There are situations and conditions that limit preventive interventions.

• Skin failure at the end of life is not the same as pressure injuries. Unavoidable pressure injuries and deep tissue injuries may also occur at the end of life, with skin failure, and following cardiac/respiratory arrest.
  (Edsberg et al., 2016; WOCN, 2016b)

Thus, the topics discussed in this course—risk assessment, prevention, management, reevaluation, and documentation—are the very factors used to determine if all that can be done for the patient has in fact been done to prevent a pressure injury.

**PRESSURE INJURIES AT END OF LIFE**

Skin changes or unusual wounds can occur at the end of life and may include deep tissue injury, pressure injuries, or ischemic/mottled wounds. Due to the underlying etiologies, these wounds are generally thought to be unavoidable. For patients at the end of life, it is important
to determine the goals of the patient and caregiver(s). Some may wish to achieve healing of the pressure injury, whereas others may desire only palliative care, including reducing pain, odor, drainage, bleeding, and infection, and simplifying dressing changes for comfort. The patient and family must be educated as to realistic expectations for wound healing.

One example of skin changes at the end of life is the Kennedy terminal ulcer. This was first described in 1989. It is located on the sacrococcygeal area. It appears as a purple, red, blue, or black discoloration of the skin with a butterfly or pear shape that has irregular borders. It has a sudden onset, develops rapidly into a full-thickness wound despite appropriate care, and may precede death in days to weeks (WOCN, 2016a).

Terminal ulcer. (Source: C Melter.)

PRESSURE INJURY PREVENTION TRAINING FOR FACILTY STAFF

Having clinicians who are highly skilled in pressure prevention and treatment is important for all facilities. Equally important is training all staff, licensed or not, in the prevention and recognition of pressure injuries. Care assistants do most hands-on patient care, including bathing, toileting, dressing, and grooming. They are also the patient’s primary source of help for transfers and repositioning.

Setting up facility-wide training programs can be challenging and time consuming. A good resource to consider is the Agency for Healthcare Research and Quality (AHRQ) training program, Pressure Injury Prevention in Hospitals Training Program. This training is used in conjunction with the AHRQ Preventing Pressure Ulcers in Hospitals Toolkit. The goal of the
program is to enable hospitals to successfully overcome the obstacles associated with creating, implementing, and maintaining a pressure injury prevention program.

(See “Resources” at the end of this course.)

CONCLUSION

Pressure injuries are a life-threatening problem among vulnerable individuals, including those who are bed- or chair-bound and those who are critically ill. Nearly all pressure injuries are considered preventable, and this requires a full commitment by the healthcare facility and individual clinicians so that a pressure injury will not occur.

There are many factors that contribute to the formation of a pressure injury, including comorbidities, incontinence, poor nutrition, and advanced age, but the most significant risk factor is immobility. Patients who are dependent on others for repositioning are at greatest risk of developing a pressure injury, for nonhealing of a pressure injury should it occur, and for the recurrence of a pressure injury.

Pressure injuries can be prevented through both an “outside” approach (which includes minimizing pressure through regular repositioning, using a support surface, and managing incontinence) and an “inside” approach (which includes managing nutrition and hydration to support health and healing).

Treating a pressure injury that has developed involves these same activities, together with treating the wound itself, frequently reassessing the wound, and reducing the factors that inhibit wound healing. Pressure reduction measures are the most important. Further strategies for pressure injury treatment include cleansing the wound, managing wound infections, debriding the pressure injury of devitalized or necrotic tissue, and utilizing appropriate dressings. By carrying out these strategies, clinicians provide the wound with the environment it needs to heal.

Finally, healthcare professionals, patients, and caregivers must be vigilant about monitoring for pressure injury recurrence. Failing to protect the development of pressure injuries or to care for existing pressure injuries puts all patients and the healthcare system in jeopardy for what is often a costly but avoidable complication.
RESOURCES

Braden Scale
http://bradenscale.com

Braden-Q Scale (for pediatric population)

Frequently asked questions about maggot debridement therapy
http://www.bterfoundation.org/faq_MDT

Medical maggots
http://www.monarchlabs.com/mdt

Norton Scale

Pressure Injury Prevention in Hospitals Training Program (AHRQ)

Pressure Ulcer Scale for Healing (PUSH)
https://npiap.com/page/PUSHTool

REFERENCES


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TEST

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1. According to the NPIAP definition of pressure injuries, the tolerance of soft tissue for pressure and shear may be affected by several factors, including:
   a. Seasonal variations in climate.
   b. Use of cosmetic products.
   c. The gender of the patient.
   d. Microclimate and nutrition.

2. Which statement most accurately reflects the impact of hospital-acquired pressure injuries (HAPI)?
   a. There has been a steady decline in the number of HAPI in recent years.
   b. HAPI are found only in patients over 70 years of age.
   c. Between the years 2014–2017, the number of HAPI increased.
   d. The cost of treating HAPI has decreased over the years.

3. Which statement best describes the purpose of assessing a patient’s risk for developing a pressure injury?
   a. To comply with a legal requirement
   b. To complete the Braden scale
   c. To initiate prevention measures
   d. To determine the level of care needed for older adults

4. A patient with a diagnosis of a fractured hip is at a higher risk for which pressure injury?
   a. Bilateral scapula pressure injury
   b. Heel pressure injury
   c. Coccyx pressure injury
   d. Medial ankle pressure injury

5. Skin tears occur more frequently in older adult patients due to:
   a. Decrease in skin temperature.
   b. Flattening of the epidermal-dermal junction.
   c. Loss of protective immune system mechanisms.
   d. Decrease in cell size.

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6. Regardless of the healthcare setting, a patient’s risk of developing pressure injuries should be assessed:
   a. At each shift change.
   b. Whenever the patient’s condition changes.
   c. Every 24 to 48 hours.
   d. Only if a pressure ulcer develops.

7. A male patient who is admitted with congestive heart failure reports that he spends all day at home in his recliner, even sleeping in it. Which area of the patient’s body is checked first for possible skin issues and pressure injury risk?
   a. The ears
   b. The toes
   c. The sacrum
   d. The trochanters

8. Which patient risk factor is most likely to result in the development of a pressure injury?
   a. Incontinence
   b. Friction
   c. Immobility
   d. Nutrition status

9. Keeping the patient’s head of the bed at or below 30 degrees prevents skin damage due to:
   a. Shearing.
   b. Fecal incontinence.
   c. Urinary incontinence.
   d. Immobility.

10. In a patient whose skin status was assessed upon admission with the Braden scale, which scale should be used for subsequent skin assessments?
    a. Braden
    b. Norton
    c. Waterloo
    d. Hospital-based
11. After assessing a nonmobile patient who is sitting up in a wheelchair, the clinician determines that the wheelchair may place this patient at **increased** risk for pressure injuries based on which finding?
   a. The patient’s thighs are maintained parallel to the floor.
   b. The patient is able to independently perform periodic pressure relief while sitting in the wheelchair.
   c. The wheelchair has no supportive cushion.
   d. The wheelchair was customized specifically for this patient’s height, weight, and mobility level.

12. The most important feature of a support surface is its ability to:
   a. Support a patient’s weight.
   b. Reduce friction.
   c. Redistribute pressure.
   d. Alert the staff when the patient moves.

13. In selecting a support surface for the bedridden patient, which is the clinician’s **first** consideration?
   a. The patient’s condition
   b. The availability of the support surface product
   c. The cost of the support surface product
   d. The availability of someone to turn the patient

14. Preventing incontinence-associated dermatitis is **best** accomplished by:
   a. Placing a urinary catheter in the patient.
   b. Scrubbing the patient’s skin with soap and water.
   c. Placing several underpads under the patient.
   d. Cleaning the patient’s skin with perineal cleansers.

15. Which intervention for urinary incontinence has been found helpful in preventing post-void dribbling?
   a. Pelvic floor muscle training
   b. Scheduled toileting
   c. Habit retraining
   d. Electric stimulation
16. The patient is admitted to ICU on a ventilator with orders to keep the head of the bed at 45 degrees to prevent pneumonia. Which prophylactic intervention could help to prevent pressure injury formation at the sacrum?
   a. Foam dressing placed on the sacrum
   b. Gauze dressing placed on the sacrum
   c. Pillows underneath the knees for extra leg support
   d. Asking the doctor to further elevate the head of the bed

17. When determining the risk for pressure injury in pediatric patients with tracheostomies, the clinician is aware that:
   a. Tracheostomy-related pressure injury only occurs in older children.
   b. Pressure injury risk is directly associated with the size of the tracheostomy tube.
   c. Frequent use of cleansing agents around the tracheostomy site increases the risk for pressure injury.
   d. Pressure injury can occur directly under the tracheostomy device and also under the securement ties.

18. The clinician documents a pressure injury consisting of a fluid-filled blister and several ruptured blisters as:
   a. A stage 1 pressure injury.
   b. An acute wound.
   c. A chronic abrasion.
   d. Stage 2 pressure injuries.

19. A pressure injury is classified as stage 4 when there is visible:
   a. Slough.
   b. Blanching.
   c. Bone.
   d. Subcutaneous fat.

20. The term “reverse staging” cannot be used to describe the process of pressure injury healing because:
   a. Reverse staging is applicable only to acute wounds.
   b. Reverse staging is used only when there is surgical intervention.
   c. Staging cannot accurately describe tissue perfusion in a healing wound.
   d. Staging is used only to describe the amount and type of tissue destroyed based on anatomical depth.
21. The clinician finds a blood-filled blister on the patient’s heel. Suspecting a deep tissue pressure injury, the clinician’s first action is to:
   a. Notify the physician.
   b. Document the assessment.
   c. Relieve pressure off the heel.
   d. Wrap a gauze dressing over the blister.

22. Which is a correct statement regarding the use of water in pressure injury cleaning?
   a. Water is never a suitable agent to use in the cleaning of an open pressure injury.
   b. Water is only used if no other cleansing agent is available.
   c. Water can be used to clean stage 2 pressure injuries only.
   d. Water suitable for drinking can be used to clean most pressure injuries.

23. Which sign or symptom may indicate a systemic infection associated with a pressure injury?
   a. Friable granulation tissue
   b. Necrotic tissue
   c. Lack of signs of healing
   d. Fever and malaise

24. So that a wound culture will reflect the actual bacterial status of the wound, the clinician should be careful to swab only:
   a. Wound exudate.
   b. Devitalized tissue.
   c. Healthy-looking tissue.
   d. Periwound skin.

25. A contraindication to debridement of dry, stable eschar is:
   a. The ulcer is on an ischemic limb.
   b. The patient is over 60 years of age.
   c. The patient has been admitted to hospice.
   d. The wound is infected.

26. Which method of debridement is the quickest way to remove extensive necrotic tissue, undermining, and tunneling?
   a. Mechanical debridement
   b. Surgical sharp debridement
   c. Autolytic debridement
   d. Enzymatic debridement
27. Which is the best choice for a heavily draining pressure injury requiring a dressing that provides maximum absorption?
   a. A hydrocolloid dressing  
   b. An alginate dressing  
   c. A hydrogel dressing  
   d. A gauze dressing

28. When reviewing an order to apply a hydrogel to a wound bed and then fill the wound with a hydrofiber, the nurse questions the order because:
   a. They both add moisture to the wound.  
   b. They both absorb moisture from the wound.  
   c. They are physically incompatible materials.  
   d. One adds moisture and the other absorbs moisture.

29. A pressure injury has not decreased in size in two weeks, and the clinician suspects critical colonization. What change to the treatment plan does the clinician recommend?
   a. Apply topical antibiotics to the wound bed.  
   b. Decrease the frequency of dressing changes.  
   c. Apply gauze dressings impregnated with PHMB.  
   d. Apply a multilayer gauze dressing.

30. In a pressure injury that has been deemed suitable for autolytic debridement, which dressing is appropriate?
   a. Dry gauze  
   b. Alginate  
   c. Foam  
   d. Hydrocolloid

31. How often are negative-pressure wound dressings usually changed?
   a. Once a week  
   b. Every 48 to 72 hours  
   c. Daily  
   d. As needed
32. Which factor is likely responsible for improved wound healing after treatment is begun for a patient’s poor circulation?
   a. Reduced tension on the wound
   b. Greater tissue oxygenation
   c. Decreased blood sugar level
   d. More frequent dressing changes

33. When documenting the location of undermining in a wound, which is the most accurate descriptor to use?
   a. “Top to bottom”
   b. “From the wound edge to the center”
   c. “From left to right”
   d. “From 10 o’clock to 5 o’ clock”

34. During each dressing change procedure, the clinician documents the amount and consistency of wound drainage, the presence or absence of wound odor, and:
   a. The shape of the wound.
   b. Irregularities in the depth of the wound.
   c. The appearance of the wound bed.
   d. Estimated surface area of the wound.

35. The spouse of a patient with dementia and limited mobility reports a new area of redness over the “right hip bone” after the patient had been lying on his right side for an afternoon nap. What is the first step the clinician advises the patient to take?
   a. Off-load pressure to the area and recheck again in 15 minutes.
   b. Gently massage the area with a mild skin moisturizer.
   c. Return to bed and take a nap.
   d. Take a warm shower and use a soft cotton towel to dry.

36. In a patient who developed a reportable pressure injury while hospitalized, which factor discovered during root cause analysis signaled that the pressure injury was avoidable?
   a. The effectiveness of interventions to prevent pressure injury were not monitored.
   b. Risk assessments were performed regularly by nurses.
   c. The patient received education on pressure injury prevention.
   d. The physician documented on admission that a pressure injury was likely unavoidable.