Pressure ulcer

Clinical Education

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MKL-375, REV-2, 1010

PRESSURE ULCER: Clinical education

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Introduction

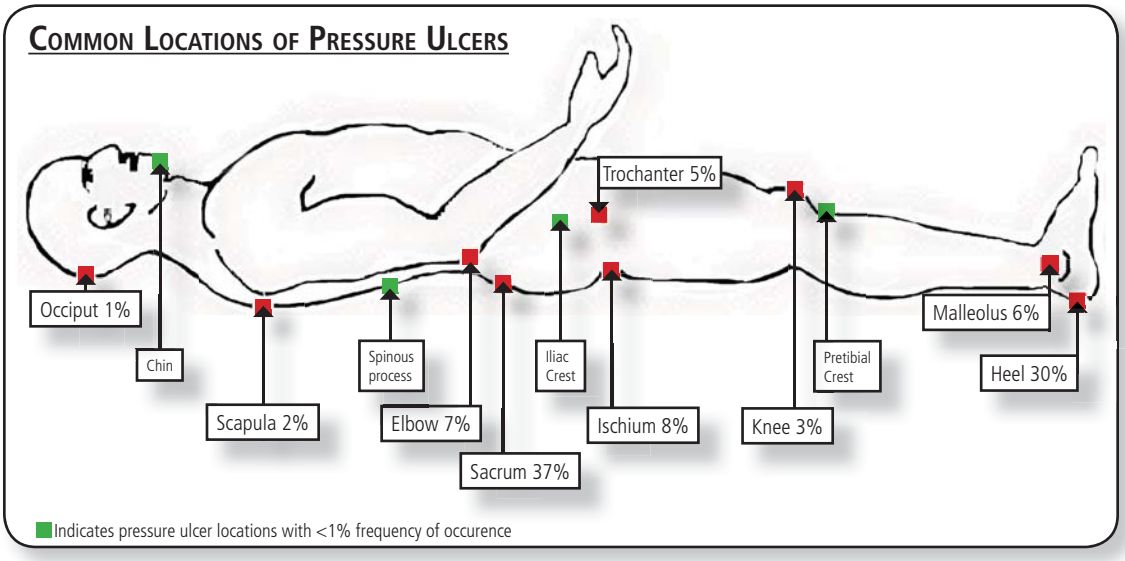
This protocol, procedure, decision tree, treatment kit and pocket guide are all designed to facilitate preparation of educational materials for communities that include families, patients and staff in order to increase the implementation of evidence-based recommendations.[1,2] Implementation of pressure ulcer prevention and treatment protocols can result in a significant reduction in the number of newly developed pressure ulcers, as well as substantial litigation savings.[3] Guideline implementation is most likely to be successful when it includes reminder systems, education and a toolkit of multiple interventions.[1,2] Over 2400 research articles have been published and at least a dozen evidence-based guidelines for prevention and treatment have been distributed, but pressure ulcers (previously called bedsores, decubitus ulcers or pressure sores)[4,5] are still a global health concern.[2,5,6] This integrated educational package summarizes the tremendous volume of information about pressure ulcers so that this body of recommendations can easily be transferred into practice.[1,2]

Historical prevalence and incidence figures cannot be compared to one another because of differences in both pressure ulcer definitions and which patients were included or excluded by the researchers.[5,7] It is known that pressure ulcers develop more frequently with aging. The most common sites in adults are the sacrum and the heels, and intensive care patients are at higher risk than less severely ill patients.[7] About 50% of all pressure ulcers are Stage I; Stages II, III and IV are progressively less common.[7]

The cost of treating pressure ulcers is staggering. Stage IV pressure ulcers often require a year or more to heal.[8] In addition to primary and secondary wound dressings and caregiver time, pressure ulcer patients often require: wound cleansers, tape, special support surfaces, radiology, consultations, surgery (including debriding and grafting), pain medications and antibiotics.[1] Facility associated pressure ulcers increase the patient's risk for developing complications as well as increasing the length of stay.[4] Pressure ulcer patients spend extra time in a more debilitated state and may develop additional complications.[1] In the USA in 2003, hospitalizations primarily for pressure ulcers cost an average of $37,800,[9] but numbers cannot reflect the impact of a pressure ulcer on a patient's quality of life or an institution's reputation.[5]

Definition

Pressure ulcers are the end result of damage to the skin and/or deeper tissues caused by mechanical forces working together.[5] According to the NPUAP, "A pressure ulcer is localized injury to the skin and/or underlying tissue usually over a bony prominence, as a result of pressure, or pressure in combination with shear and/or friction. A number of contributing or confounding factors are also associated with pressure ulcers; the significance of these factors is yet to be elucidated."[8] These contributing factors (detailed in CHART A on page Sec1:6) should not be dismissed lightly – we simply do not fully understand the complex dynamic process that culminates in the formation of a pressure ulcer.[6]



Pressure ulcers occur most frequently over the heaviest areas of the body.[2,4,5] But, they can occur anywhere pressure is exerted against soft tissue by a bony prominence or a hard object (such as a tube or bedrail).[1,4] Blanching erythema (redness that goes away with light finger pressure but then returns) will usually resolve completely in 2 – 3 days if it is off-loaded.[10] It is a warning sign, but it is not a pressure ulcer.[4]

Not all open areas on or surrounding bony prominences are pressure ulcers. Moisture lesions (from incontinence associated dermatitis or excessive sweating) are not pressure ulcers, but they reduce the resiliency of the skin, which can predispose patients to pressure ulcers.[1,4] Herpetic and candidiasis lesions may be misclassified as pressure ulcers.[4] Kennedy Terminal Ulcers are probably not true pressure ulcers.[11]

How Pressure Ulcers Develop

When pressure closes off the capillaries, the surrounding tissues are deprived of oxygen and build up waste. This damages the capillary walls,[4] causing them to leak protein. Fluid is always attracted by protein, so fluid also leaves the capillaries, causing edema. The edema creates additional pressure on the capillary walls which results in the capillaries closing at lower external pressures than in undamaged tissues.[4] The worsening hypoxia and resulting damage accelerates the cellular death and inflammation.[4] The lymph system, which usually removes excess protein from the interstitial space, is shut off by the pressure from the edema, so the protein remains in the interstitial space, which no longer has its normal flow.[4] This increased protein pulls fluid out of the cells, causing them to become dehydrated and irritated.[4] When the pressure is removed, the damaged capillaries slough into the bloodstream, which may be another source of blood vessel occlusion.[4] Pressure ulcers can develop in as little as 2 – 6 hours when normal capillary blood flow is obstructed.[12]

Three factors determine whether or not tissue damage will occur as a result of pressure:

- intensity of the pressure (critical capillary closing pressure)
- duration of the pressure (healthy people shift their weight because tissue hypoxia causes discomfort) and
- tissue tolerance to pressure (thick, well-hydrated, healthy skin is more able to redistribute the pressure because the collagen, capillaries and fluid work together like springs).[1,4]

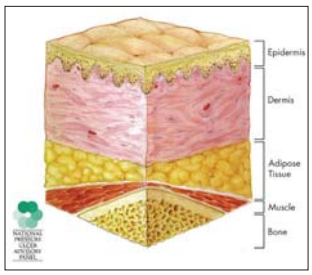
An area of nonblanchable erythema (Stage I) usually indicates mild damage that can resolve completely with meticulous offloading.[11] Tissue loss due to pressure damage is classified as a Stage II, III or IV pressure ulcer, depending upon the structural layer of exposed tissue.[8,13]

Deep Tissue Injury (DTI)

Pressure is 3 – 5 times greater at the bone than at the skin.[4,5] But, where a bony prominence is covered with muscle, the muscle distributes the load, transferring the pressure to the skin at only a small area.[4,5] Muscle tissue is far more sensitive to hypoxia than skin.[4,5,14] So, it is possible to have injury in the deep tissues without any obvious skin changes.[5,15] Dark purple, with the appearance of a deep bruise is an ominous sign, often indicating Deep Tissue Injury (DTI).[8] With DTI, if the severely damaged tissue dies, the area will open up, revealing a cavity which may extend to bone.[8] Several studies have shown that when the deep tissues are severely injured by pressure, a visible ulcer presents about two days later.[2]

The Influence of Moisture, Friction and Shear

Pressure is the major cause of pressure ulcers, but friction and shear can contribute, and excess moisture (or dryness) can make the skin more vulnerable to damage.[1] Moderate increases in moisture increase friction.[4,16] Friction alone causes sheet burns, not pressure ulcers.[4] A body that is being held back by friction and is acted upon by gravity, or a dragging force, can develop deeper injuries caused by shear.[13] Shear damages blood vessels by stretching them, rather than compressing them, and it disconnects the various levels of tissues from one another, leading to undermining in pressure ulcer-like wounds.[4] Inflammation from shear creates intense internal pressure, so while the opening at the level of the skin may be relatively benign-looking, the defect underneath tends to be quite large.[13]

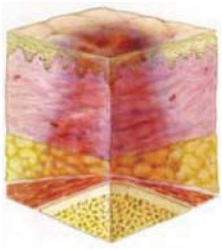


Staging:

A commonly used pressure ulcer staging tool is the classification system developed by the USA-based National Pressure Ulcer

NPUAP Staging System:[8]

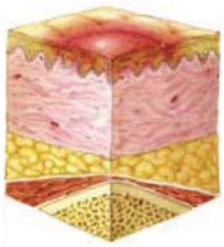
Suspected Deep Tissue Injury



DEFINITION: Purple or maroon localized area of discolored intact skin or blood-filled blister due to damage of underlying soft tissue from pressure and/or shear. The area may be preceded by tissue that is painful, firm, mushy, boggy, warmer or cooler as compared to adjacent tissue.

FUTHER DESCRIPTION: Deep tissue injury may be difficult to detect in individuals with dark skin tones. Evolution may include a thin blister over a dark wound bed. The wound may further evolve and become covered by thin eschar. Evolution may be rapid exposing additional layers of tissue even with optimal treatment.

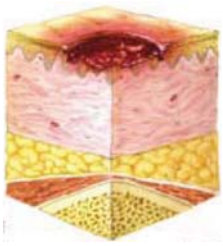
Stage I



DEFINITION: Intact skin with non-blanchable redness of a localized area usually over a bony prominence. Darkly pigmented skin may not have visible blanching; its color may differ from the surrounding area.

FUTHER DESCRIPTION: The area may be painful, firm, soft, warmer or cooler as compared to adjacent tissue. Stage I may be difficult to detect in individuals with dark skin tones. May indicate "at risk" persons (a heralding sign of risk)

Stage II

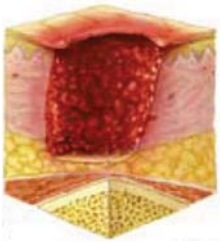


DEFINITION: Partial thickness loss of dermis presenting as a shallow open ulcer with a red pink wound bed, without slough. May also present as an intact or open/ruptured serum-filled blister.

FUTHER DESCRIPTION: Presents as a shiny or dry shallow ulcer without slough or bruising.* This stage should not be used to describe skin tears, tape burns, perineal dermatitis, maceration or excoriation.

*Bruising indicates suspected deep tissue injury

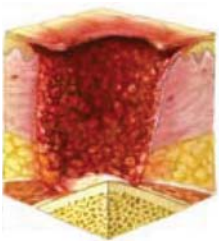
Stage III



DEFINITION: Full thickness tissue loss. Subcutaneous fat may be visible but bone, tendon or muscle are not exposed. Slough may be present but does not obscure the depth of tissue loss. May include undermining and tunneling.

FUTHER DESCRIPTION: The depth of a stage III pressure ulcer varies by anatomical location. The bridge of the nose, ear, occiput and malleolus do not have subcutaneous tissue and stage III ulcers can be shallow. In contrast, areas of significant adiposity can develop extremely deep stage III pressure ulcers. Bone/tendon is not visible or directly palpable.

Stage IV



DEFINITION: Full thickness tissue loss with exposed bone, tendon or muscle. Slough or eschar may be present on some parts of the wound bed. Often include undermining and tunneling.

FUTHER DESCRIPTION: The depth of a stage IV pressure ulcer varies by anatomical location. The bridge of the nose, ear, occiput and malleolus do not have subcutaneous tissue and these ulcers can be shallow. Stage IV ulcers can extend into muscle and/or supporting structures (e.g., fascia, tendon or joint capsule) making osteomyelitis possible. Exposed bone/tendon is visible or directly palpable.

Unstageable

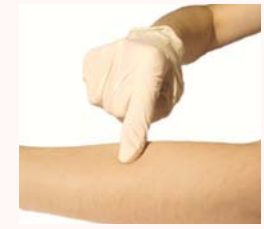
DEFINITION: Full thickness tissue loss in which the base of the ulcer is covered by slough (yellow, tan, gray, green or brown) and/or eschar (tan, brown or black) in the wound bed.

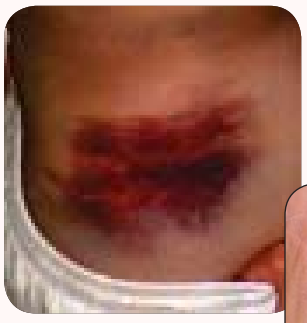
FUTHER DESCRIPTION: Until enough slough and/or eschar is removed to expose the base of the wound, the true depth, and therefore stage, cannot be determined. Stable (dry, adherent, intact without erythema or fluctuance) eschar on the heels serves as "the body's natural (biological) cover" and should not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

Advisory Panel (NPUAP).[5] Over the years, this staging system has evolved, and in 2007 it was revised to clarify the four stages and to add "unstageable" and "deep tissue injury (DTI)."[8] Current EPUAP (European) and APUAP (Australian) staging systems are very similar, although EPUAP includes DTI in the Grade IV pressure ulcer category.[8,17] NPUAP created a separate category for DTI to encourage further research and to acknowledge that aggressive early interventions, including off-loading and reperfusion, may at times result in the ischemic and injured tissues being "salvaged" rather than progressing to a full thickness wound.[8] The term "Grade" instead of "Stage" is used in Europe, but both of these terms may be replaced because they have been obstacles for some clinicians, since "grade" or "stage" may imply that a larger score represents a more serious wound.[11] In fact, staging alone does not indicate the seriousness of a pressure ulcer.[5] It is also important to note that pressure ulcers do not necessarily progress from one stage to another – the various stages of pressure ulcers may have differing causes.[8,13,18] Staging definitions for pressure ulcers involving mucous membranes, which have unique underlying tissue, are being formulated.[11]

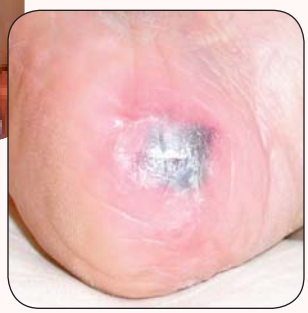
Tips for Identifying Stage I Pressure Ulcers and Deep Tissue Injuries:

Skill is required to distinguish between Stage I pressure ulcers and DTI, especially in patients with darkly pigmented skin.[8] Preliminary work on a portable gauge to detect subcutaneous pressure damage shows promise, but is not yet available.[19] To check for non-blanching erythema, apply light finger pressure for 10 seconds, release the pressure, and look for a change in skin color.[17] A pressure ulcer is beginning to form if the skin does not lighten briefly.[17] Warmness or coolness is present in 85% of patients with Stage I pressure ulcers.[5] Checking for changes in skin temperature (warmer or cooler) or sensation (pain or itching) can help clinicians detect Stage I pressure ulcers on patients with darkly pigmented skin.[5,7] Ultrasound can also be used to detect Stage I pressure ulcers in darkly pigmented skin.[5] Nonblanching erythema suggests that blood has leaked into the tissues due to ischemic damage to the vessels. This must be differentiated from a Deep Tissue Injury, which is boggy or indurated (overly firm), through palpation.[4] The discoloration of a true bruise (an injury caused by acute trauma, not prolonged pressure) extends into the epidermal layer of skin, while in pressure-related Deep Tissue Injury, the pigment of this outer layer of skin may be unaffected.[11]





Example of bruise on hip



Example of DTI on heel

Prevention

Prevention of pressure ulcers requires two things: improving skin health to promote increased tissue tolerance and decreasing exposure to excessive pressure, friction, moisture and sheer (for specifics, see Reducing Risk Factors). This can be accomplished through a formal, evidence-based pressure ulcer prevention program, which usually includes:[4]

- **A Risk Assessment, Such As The Braden Scale (Norton, Waterlow and Braden Q can also be used)**
- **A Systematic Skin Assessment**
- **Reducing Risk Factors**
- **Patient, Family and Staff Education**
- **Evaluation**

Introducing a formal risk assessment program linking levels of risk to prevention protocols can dramatically decrease the incidence and severity of pressure ulcers in a facility.[5] The New Jersey Hospital Association's (NJHA) Pressure Ulcer Collaborative demonstrated a 30% reduction in pressure ulcer incidence across 150 participating organizations in the first year of implementation, with some agencies reporting >70% reductions by the end of year two.[20]

Risk Assessment:

It is cost-prohibitive to apply all known risk-reducing interventions to all patients.[4,5,21] In the absence of a formal tool, clinicians usually intervene only at the highest levels of risk.[22] Using a formal risk assessment scale is cost effective because interventions are targeted to real needs.[1,21] Assessment-based prevention significantly decreases both the total number of pressure ulcers and the severity of the pressure ulcers that do occur, with dramatic cost savings.[21,22] Risk assessments take only about 30 seconds to complete when the nurse is familiar with the patient.[4]

The Norton Scale was the first pressure ulcer risk assessment scale to be developed. It is very simple to use, but it tends to over-estimate risk.[1,4,7] The Braden Scale is excellent at distinguishing between high risk and low risk patients.[1,5,7,22,23] The Braden Q is an adaptation for pediatric populations.[4,7] The Waterlow scale measures more parameters than the other scales, but it does not distinguish between high and low risk patients as well as either the Norton or the Braden scale.[7,24,25] All of these scales are best implemented by RNs; vocational nurses and aides require extensive additional training to use the scales accurately.[1,4,7,21] Nonprofessional staff should be taught how to use the scale in settings where RNs are somewhat removed from direct observation of the patient's daily activities.[21] Web-based training on the use of the Braden Scale has proven highly successful.[5,26]

A formal risk assessment using a validated scale should be performed on all patients upon admission, whenever the patient's condition changes, and at the following intervals:

Acute care: every 24 - 48 hours,
Critical Care: every 24 hours,
Home Care: at each nurse visit,
Long Term Care: weekly for the first month, then monthly or quarterly.[4,5,17,27]

As many as 96% of patients who develop pressure ulcers in long term care do so within three weeks of admission, so care providers must be especially vigilant during this time period.[1,5,28] Patient charts should include an easy-to-use check-box tool to remind clinicians to perform the risk assessment on schedule.[15]

The Braden Scale is the most widely used tool for assessing pressure ulcer risk.[22,29] A numerical value is assigned to six major predictors of pressure ulcer risk.[21] Deficit in sensory perception, decreased physical activity and decreased mobility measure exposure to intense or prolonged pressure.[21] Excess exposure of the skin to moisture, decreased nutrition and problems with friction and shear measure tissue tolerance for pressure.[21] The first 5 parameters are scored 1 – 4. Friction and shear is scored 1 - 3. Lower scores indicate higher risk.[22] The scores are tallied for a total of 6 – 23. Originally a score of 16 was thought to indicate an increased risk for pressure ulcers, but 18 is the currently accepted number for all elderly population groups.[5,21,22,29]

Risk assessment scales should augment, rather than replace, the nurses' clinical judgment in order to identify patients at risk and apply preventive measures based upon the specific identified deficits.[5,7,17,27,30,31]

When considering a patient's risk for the development of pressure ulcers, an assessment of person-specific risk factors should be used in conjunction with the risk assessment score.[1,18,28] All bed-bound or chair-bound persons and those whose ability to reposition independently is impaired are considered at risk for pressure ulcers by the NPUAP.[32] Advanced age, increased body temperature and low blood pressure are the most significant additional risk factors for pressure ulcers.[1,5,18,33]

Most risk assessments do not take into consideration all factors that can contribute to pressure ulcer development.

See CHART A on Sec1:6 for some factors that might not be considered.

The purpose of the risk assessment is not simply to score patients to identify which ones are most likely to develop pressure ulcers.[5,14] The risk assessment is a tool used to identify specific deficits which must be addressed for each individual patient in order to decrease their risk of ulceration.[5,14,15]

Interventions to compensate for deficits in the sensory perception, mobility and activity components of the Braden Scale include the implementation of appropriate support surfaces (including heel protection) and repositioning

Braden Scale for Predicting Pressure Sore Risk

SENSORY PERCEPTION ability to respond meaning - fully to pressure-related discomfort	**1. Completely Limited** Unresponsive (does not moan, flinch, or gasp) to painful stimuli, due to diminished level of consciousness or sedation. OR limited ability to feel pain over most of body	**2. Very limited** Responds only to painful stimuli. Cannot communicate discomfort (except by moaning or restlessness) OR has a sensory impairment which limits the ability to feel pain or discomfort over ½ of body.	**3. Slightly Limited** Responds to verbal commands, but cannot always communicate discomfort or the need to be turned. OR has some sensory impairment which limits ability to feel pain or discomfort in 1 or 2 extremities.	**4. No impairment** Responds to verbal commands. Has no sensory deficit which would limit ability to feel or voice pain or discomfort.				
MOISTURE degree to which skin is exposed to moisture	**1. Constantly Moist** Skin is kept moist almost constantly by perspiration, urine, etc. Dampness is detected every time patient is moved or turned.	**2. Very Moist** Skin is often, but not always moist. Linen must be changed at least once per shift.	**3. Occasionally Moist:** Skin is occasionally moist, requiring an extra linen change approximately once a day.	**4. Rarely Moist** Skin is usually dry, linen only requires changing at routine intervals.				
ACTIVITY degree of physical activity	**1. Bedfast** Confined to bed.	**2. Chairfast** Ability to walk severely limited or non-existent. Cannot bear own weight and/or must be assisted into chair or wheelchair.	**3. Walks Occasionally** Walks occasionally during day, but for very short distances, with or without assistance. Spends majority of each shift in bed or chair.	**4. Walks Frequently** Walks outside room at least twice a day and inside room at least once every two hours during waking hours.				
MOBILITY ability to change and control body position	**1. Completely Immobile** Does not make even slight changes in body or extremity position without assistance	**2. Very Limited** Makes occasional slight changes in body or extremity position but unable to make frequent or significant changes independently.	**3. Slightly Limited** Makes frequent though slight changes in body or extremity position independently.	**4. No Limitation** Makes major and frequent changes in position without assistance.				
NUTRITION usual food intake pattern	**1. Very Poor** Never eats a complete meal. Rarely eats more than 1/3 of any food offered. Eats 2 servings or less of protein (meat or dairy products) per day. Takes fluids poorly. Does not take a liquid dietary supplement OR is NPO and/or maintained on clear liquids or IV's for more than 5 days.	**2. Probably Inadequate** Rarely eats a complete meal and generally eats only about 1/2 of any food offered. Protein intake includes only 3 servings of meat or dairy products per day. Occasionally will take a dietary supplement OR receives less than optimum amount of liquid diet or tube feeding	**3. Adequate** Eats over half of most meals. Eats a total of 4 services of protein (meat, dairy products per day. Occasionally will refuse a meal, but will usually take a supplement when offered OR is on a tube feeding or TPN regimen which probably meets most of nutritional needs	**4. Excellent** Eats most of every meal. Never refused a meal. Usually eats a total of 4 or more servings of meat and dairy products. Occasionally eats between meals. Does not require supplementation.				
FRICTION & SHEAR	**1. Problem** Requires moderate to maximum assistance in moving. Complete lifting without sliding against sheets is impossible. Frequently slides down in bed or chair, requiring frequent repositioning with maximum assistance. Spasticity, contractures or agitation leads to almost constant friction.	**2. Potential Problem** Moves feebly or requires minimum assistance. During a move skin probably slides to some extent against sheets, chair, restraints, or other devices. Maintains relatively good position in chair or bed most of the time but occasionally slides down.	**3. No Apparent Problem** Moves in bed and in chair independently and has sufficient muscle strength to lift up completely during move. Maintains good position in bed or chair.					
					Total Score			

schedules.[21,30] Issues with moisture, nutrition and shear are usually managed more directly.[21] Visual cues, such as colored markings or stickers on the chart, ID band or room door can help remind staff that the patient is at increased risk for pressure ulcers.[15]

Systematic Skin Assessment:

The admission assessment should include a complete head-to-toe skin assessment for all patients.[15,30] Care of Stage III and IV pressure ulcers in acute care patients are eligible for Medicare or Medicaid reimbursement only if this assessment is documented promptly.[15] Patients who are in the emergency department (ED) awaiting a bed for an extended period of time should have this assessment performed by the ED staff.[15]

Daily skin assessments should be performed on all at-risk patients at a convenient time, such as when bathing, dressing or assisting the patient.[4,15,17,27] A thorough skin inspection requires the removal of all devices and fitted garments.[4] Special attention should be paid to the areas of the skin that are the most vulnerable to breakdown for the individual patient.[4,17]

The daily skin assessment should evaluate:

- integrity and lesions,
- hydration/moisture (include a skin mobility check for edema and dehydration),
- temperature,
- odor,
- texture,
- color (very important – requires good light),
- nails,
- hair

Also ask family or other care providers if they have noticed any skin changes.[4]

All changes in skin integrity should be documented and promptly communicated with the appropriate staff member so that interventions can be initiated.[15]

CHART A

How factors not addressed by most risk-assessment scales contribute to pressure ulcer formation:

- Aging causes the skin to have less efficient nutrient exchange and less resistance to shear forces because of the flattening of the rete ridges and atrophy of the blood and lymph vessels,[1,34] decreased dermal thickness,[1,34] atrophy of the subcutaneous and muscle layers causing a lack of cushioning at the bony prominences[4] and systemic changes.[1,4,5,18,34]
- Increased body temperature (fever) increases oxygen demand to the tissues.[1,4,5,18,28] The resting oxygen demand of a neutrophil is 30 times greater than that of an epithelial cell.[4] Collagen synthesis is also negatively affected by temperature.[35]
- Low blood pressure (systolic below 100 or diastolic below 60)[1,28] decreases capillary closure pressures and causes blood to be shunted from the skin to the vital organs.[1,4,5]
- Extended time on the operating table or hypotensive episodes predispose patients to pressure ulcers because of decreased skin perfusion.[4] These pressure ulcers may be as non-preventable as acute renal failure in critically ill patients.[34]
- Hemodynamic instability, which makes it unsafe to turn patients, dramatically increases risk for the development of pressure ulcers.[34]
- Pain and other psychological stressors are associated with pressure ulcers,[1,22] especially in children,[31] because stress triggers cortisol release, which may cause collagen degradation and interfere with diffusion of nutrients to the skin.[4] Stress also significantly increases the rate of infection and slows wound healing.[36]
- Increased blood viscosity from any cause (most often dehydration or medications) will decrease tissue tolerance.[1,4]
- Smoking is correlated with pressure ulcers in spinal cord injured patients.[4,18] Smoking alters collagen synthesis and decreases tissue perfusion.[5,35]
- Scarred areas have only about 40% of the tensile strength of the original tissue[8] so they are especially susceptible to pressure damage.[1,4]
- Contractures decrease a patients' mobility and make turning the patient difficult. This causes an increased risk of pressure ulcer formation.[18] Contracture release surgery should be considered for pressure ulcer patients prior to scheduling flap surgery.[1]
- Spasticity and external braces and appliances, especially in children,[31] predispose patients for pressure ulcers from prolonged or repetitive contact with hard objects.[5]
- Obesity causes decreased mobility and makes it more difficult for staff to adequately reposition the patient.[4,37] Also, fat tissue has relatively poor circulation.[37]
- Diabetes influences tissue perfusion,[5] affects collagen synthesis,[35] decreases sensation to the feet and increases pressure ulcer risk.[18]

Reducing Risk Factors:

Deficits identified by the risk assessment tool serve as a basis to guide measures to alleviate, reduce or compensate for the identified risk factors.[4,17] For example, when nutrition deficits are identified by the risk assessment tool, patients should be given the nutritional support needed to raise their weight and protein to healthier levels.[4,17] By conscientiously addressing the identified risk factors, it is often possible to prevent pressure ulcers, even in high risk patients.[17,39] But, it is not possible to completely eliminate or compensate for all risk factors, and at times it is clearly not in the overall best interest of a patient to do so; some pressure ulcers may therefore be inevitable.[6,8,34] Patients have the right to choose their treatments;[34] patient care must remain flexible.[27] The skin, like other organs, can fail.[34] The distinction between inevitable skin failure and preventable pressure ulcers may lie in the overall health of the patient.[34] If a pressure ulcer develops even though appropriate assessment and interventions are implemented and documented, the pressure ulcer is considered unavoidable.[34]

Steps for Improving Tissue Tolerance:

Optimize nutrition and hydration:

Most patients with Stage III or IV pressure ulcers have low prealbumin levels, low body weight, and are not taking in enough nutrition to meet their needs.[4] Impaired nutritional intake, particularly protein intake, as well as impaired ability to self feed and recent weight loss are all independent predictors of pressure ulcer development.[1,4,29] A lean body weight loss of 30% can lead to pressure ulcer development with no ability to heal.[35] Laboratory values are helpful, but not required, for assessment and intervention.[35] Monitoring the patient's weight over time, along with assessing for edema from protein malnutrition, remains the most reliable and inexpensive method of determining whether or not a patient is developing an increased risk for pressure ulcers.[35,40]

Decreasing serum albumin and body weight are indicators of poor health that may not always be related to nutritional intake.[4] A dietician should be consulted to evaluate patients identified by the pressure ulcer risk assessment tool as having nutritional deficits to determine likely causes of poor dietary intake, such as chewing or swallowing problems or inadequate assistance.[30,35] Occupational therapists can often create assistive devices and help with positioning patients to improve self-feeding. Difficulty chewing may be correctable if it is caused by dental problems or mouth pain. A speech language pathologist can assess and offer recommendations for patients with swallowing difficulties, which can affect both nutrition and hydration.

Low protein levels decrease resistance to infection and cause edema, which decreases oxygen diffusion into the tissues.[4,35] Protein intake higher than 100% of the recommended daily allowance (RDA) appears to provide

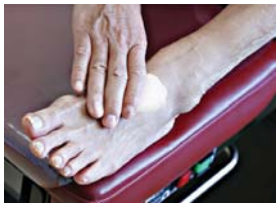
some protection from pressure injury,[28] but liver and renal function should be assessed before increasing protein intake beyond 100% of the RDA.[21] Nitrogen lost in the exudate of draining pressure ulcers can increase protein needs.[35] Protein recommendations for a patient with a pressure ulcer are 1.25 – 1.5 g protein/kg of body weight/day.[4,35,41] Excess dietary protein beyond 2.0 g/kg/day may increase the risk of dehydration, especially in elderly patients.[35] Supplementation of up to 2.4 g/kg/day may be necessary in adult patients with heavily draining wounds[42] and pediatric patients' needs may be even higher.[43] Recommendations for caloric intake for patients with pressure ulcers are 30 – 40 kcal/kg/day due to a higher resting metabolic rate.[4,35,41] An obese patient can be malnourished and will still need protein to heal wounds, so it may be appropriate to defer a weight-loss diet until after the wound is closed.[4]

When adequate oral intake is not feasible, enteral (tube) feeding is recommended; it is safer for the patient than total parenteral nutrition (TPN).[42] A daily multivitamin-mineral supplement is appropriate if deficiencies are confirmed or suspected, but in the absence of a deficiency, there is no evidence that pharmacologic doses prevent pressure ulcers.[35] In fact, zinc supplementation in excess of 40 mg/day significantly increases the odds of developing a pressure ulcer, perhaps by interfering with copper absorption.[35] There is no reliable evidence that supplemental arginine or glutamine helps to prevent or speed healing of pressure ulcers.[35]

Supplemental fluid given to pressure ulcer patients with low tissue oxygen perfusion can improved tissue oxygen.[4,44] Reperfusion may salvage tissue damaged by DTI.[8] Draining wounds, fever and air fluidized beds contribute to dehydration.[35] If a patient has a tendency to become dehydrated, each staff member who interacts with the patient or repositions them can encourage the individual to take "a few sips."[15,32]

Skin care

Skin that is damaged by irritants, friction or moisture is more easily broken down by pressure and shear.[5] Soap and hot water dry the skin by removing the natural lubricants from the skin, and soap tends to raise the pH, making the skin more susceptible to injury, so their use should be avoided.[4] Skin care products used for perineal care should be nonirritating, non-sensitizing and pH balanced.[1] Two long term care facilities documented the results of implementing skin care protocols that included use of a body wash and a skin protectant.[45] The incidence of Stage I and Stage II pressure ulcers was reduced and healing time decreased.[45] Some elderly patients may benefit from less frequent baths – applying lotion may be more appropriate at times.[5] Non-sensitizing moisturizers should be used regularly on individuals with dry skin.[17] Avoid vigorous massage of pressure areas, as it may further injure fragile capillaries.[4,5,15]



Incontinent patients should be cleaned quickly and gently after each episode using a pH balanced cleanser.[4,5] Urinary catheters should be considered for short-term use only.[4] Incontinence is best addressed by resolving the cause through a bowel or bladder program.[5,21] When incontinence cannot be resolved, topical barriers, absorbent pads or briefs, pouching devices and fecal containment systems can help protect the skin from damage.[4,21,32] Avoid thick pads; they can negate the effects of support surfaces. Incontinent patients are at increased risk for fungal infections and moisture lesions as well as pressure ulcers, so their skin should be carefully assessed at least daily.[4] Wounds should be dressed appropriately to contain all drainage.[21] Causes of diaphoresis should also be explored and an alternative support surface should be considered when it remains problematic.[21] Absorbent powders are not recommended because they can collect in skin folds and cause injury.[21]

Steps for Minimizing Injury from Excessive Pressure, Friction and Sheer:

Pressure redistribution, through repositioning and the use of appropriate support surfaces, is used to reduce the duration and intensity of pressure to help prevent pressure ulcers.[4] Issues with friction and sheer must also be addressed. All interventions should be clearly documented in the patient's medical record.[27] It is important to match the specific risk with the corrective measure. For example, an at-risk patient who spends long periods of time sitting needs a pressure redistribution device in his chair, but not necessarily on his bed. Health care professionals may tend to overlook young healthy-looking paralyzed patients' need for pressure redistributing beds and devices, but pressure ulcers are common in these patients[5] and can be fatal.

Repositioning:

Maintaining activity level, mobility and range of movement are appropriate goals for most individuals.[27] Rehabilitation programs can facilitate meeting these objectives.[32] Patients who do not reposition themselves naturally should be regularly repositioned by staff.[7,32] In one study, 90% of patients who moved on their own fewer than 20 times in a night developed a pressure ulcer.[18]

Support surfaces are classified as Group 1, 2 or 3, based upon reimbursement criteria.[4,5]

* Group 1 devices are static, rather than dynamic.[5]
* Group 2 includes alternating and low-air-loss mattresses.[5]
* Group 3 includes only air-fluidized beds.[5]

Technology cannot replace good nursing care.[1] Turning is necessary even with the most sophisticated support surface.[4] Guidelines state that patients must be turned at least every two hours if Group 1 support surfaces are used and at least every 2 – 4 hours if Group 2 or 3 support surfaces are used.[4,7] More frequent turning may be indicated for patients with extremely high risks that cannot be otherwise corrected.[4,5,15] Even hemodynamically unstable patients can be repositioned with minor shifts to the hips and shoulders to provide some decrease in the duration of pressure over a single area.[4]

The 90-degree side-lying position exerts intense pressure over the trochanter, so the 30-degree lateral position should be used instead.[4,5,17,37] Patients can also be positioned prone (face down), but careful padding is needed to make this position comfortable.[1] Pillows and wedges should be used to support the patient and prevent bony areas such as the knees and ankles from touching each other.[4,18] Feet must be supported to avoid foot drop,[5] and care must be taken to prevent knee hyperextension. Care should be taken to ensure that pillows and wedges used to maintain positioning do not interfere with the action of the pressure redistribution surfaces in use.[27] Pressure injury can occur beneath a large panniculus (fatty abdominal tissue).[37] When obese patients are repositioned, care should be taken to reposition the panniculus so that air can circulate under it when the patient is in a side-lying position.[37] Shear forces should be minimized when repositioning patients.[27]

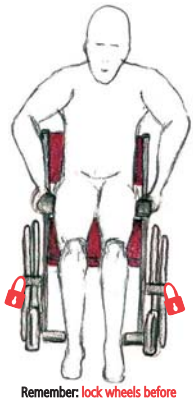
Repositioning patients may be the most expensive pressure ulcer prevention measure undertaken in a facility, because of high labor costs involved.[23] Avoiding extraneous repositioning of patients through the use of risk assessments and turning schedules can help control costs.[23] Using a routine schedule makes it easy for staff to see if a patient has been turned.[4] But, the use of rigid turning schedules is not always sufficient to prevent pressure ulcers[4] and they are not appropriate if they conflict with patients' needs.[5] Care providers must address the repositioning needs of patients who would normally be capable of turning themselves but are temporarily incapacitated by medications, or restraints, or are intimidated by fear of pain or unfamiliar medical devices.

Heels:

The heels are at particular risk for developing pressure ulcers due to their small surface area[4] and lack of subcutaneous tissue for padding.[15] Diabetes predisposes patients to developing heel pressure ulcers, so care providers should be especially vigilant in off-loading the heels of these patients.[4] Heel and elbow protectors designed to decrease friction and sheer may not redistribute pressure.[20] Nurses often place surgical gloves filled with water under patients' heels in an attempt at pressure redistribution, but these improvised devices may create more pressure than standard mattresses.[5] Commercial products can be used to redistribute pressure from the heels onto the patient's calves, but elevation with a bed pillow or folded blanket may be even more effective.[4,5] Care should be taken to distribute the pressure over the muscular surface of the calf so that the Achilles tendon is not compromised.[5,46]

Chairs:

Individuals who are wheel-chair bound will often develop pressure ulcers over the ischial and trochanter areas, rather than at the sacrum. At least every hour, patients who are unable to reposition themselves in chairs should be stood upright briefly or their legs should be elevated or lowered.[4,5,32] Individuals who are capable should be educated to lift themselves up from the chair surface[27] or shift their weight every 15 minutes.[4,5,17,27]

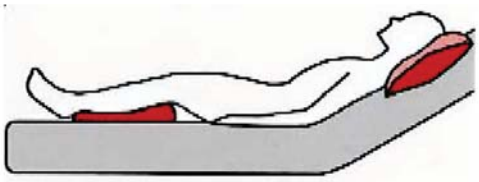


Remember: lock wheels before lifting or shifting weight

Appropriate pressure redistributing chair devices should be employed for all chair-bound individuals as well.[4,47] Ring-shaped ("donut") cushions do not redistribute pressure sufficiently to prevent pressure ulcers[4] and should not be used. Involuntary movement in a chair can result in friction and shear injuries, so seating surfaces should be customized to provide stabilization as well as pressure reduction.[4,17] Physical and occupational therapists should be consulted concerning seating angles and postural alignment.[5,17] Persons who are acutely ill should spend only limited amounts of time sitting, generally not more than 2 hours per day.[27]

Support Surfaces:

Support surfaces are defined as a mattress, mattress replacement, overlay or seat cushion designed for the management of tissue loads, microclimate or other therapeutic functions.[48] There are three methods of pressure redistribution: immersion, which spreads pressure over a large area, envelopment, which permits the mattress to conform, and moving the pressure around over time with cyclical devices.[4] These factors are influenced by the stiffness and thickness of the mattress and the flexibility of the cover.[4] Alternating and pulsating pressure devices and continuous lateral rotation therapy beds redistribute pressure by shifting body weight.[4] Evaluating and comparing support surfaces has been very difficult due to a lack of standards.[48] The NPUAP has developed uniform terminology, and plans to develop test methods and reporting requirements for full-body support surfaces.[48] No one brand of support surface has been shown to be superior for pressure ulcer prevention.[4,49] For example, sheepskin may increase comfort and decrease sheer, but it does not redistribute pressure.[4]



A pressure redistributing support surface, rather than a standard hospital mattress, should be used for each at risk individual, including in the operating room.[4] Therapeutic support surfaces are indicated for patients with stage III or IV pressure ulcers over several turning surfaces.[4] Support surfaces do not eliminate the necessity for repositioning.[4] Chair-bound pressure ulcer patients should limit sitting time and use pressure redistribution devices when they do sit.[4] Assess support surfaces for "bottoming out" by periodically placing your hand under them; you should be able to push up one inch before reaching the patient's body.[50] Special beds and chairs designed for larger patients are usually required for patients weighing over 300 pounds (135 kg).[37]

Questions to ask when evaluating a bed and support surface combination for a particular patient include:

- Can the patient sleep comfortably on this bed/support surface?[4]
- Does it make noise that disturbs the patient?[4]
- Does it make the patient too warm or cool?[4]
- Does it dry the patient's skin enough, or too much?[4]
- Is it appropriate for the patient's height and weight?[4]
- Is the system easy to set up, use, store, clean and maintiain?[4]
- Does it make repositioning the patient difficult?[4]
- Does it limit the patient's ability to get in and out of bed safely without assistance?[4]
- Does it contribute to disorientation for this particular patient?[4]
- Does the system create an increased risk of entrapment, back injuries, or falls?[4]
- Is the system affordable for the patient (including electricity costs)?[4]
- How difficult is it for the patient to be reimbursed for the system?[4]
- Has the patient developed a new pressure ulcer while using this device? Or, is the patient's wound improving?[4]

Each patient's needs must be evaluated individually to determine the appropriate bed and support surface for that patient.[4] Patients needs related to support surfaces may change as they recover or their disabilities change, so evaluation must be on-going.[4] The inflation of air-filled support surfaces must be checked daily, and water-filled devices should be inspected for leaks regularly.[4] Foam mattresses become less stiff after about 3 years of extended use.[1]

Friction and Shear:

In addition to redistributing pressure, some support surfaces can also reduce friction, sheer, moisture and skin temperature, further decreasing the patients' risk of skin breakdown.[4] In order to minimize sheer, elevate the head of the bed more than 30 degrees only when necessary;[5,14,15,21] usually it can be returned to a lower angle one hour after each meal.[4,14] Even when support surfaces are designed to minimize friction, patients should not be dragged across them – they should be lifted using appropriate means, such as a lift-sheet.[4,5,15,21,37] Some patients may be able to safely lift themselves up and move themselves back up to the head of the bed if a trapeze is provided,[21,37] or if the bed is temporarily placed in the Trendelenburg position for them. Mattress features to minimize friction and shear can be negated by adding bed linens that have a rough texture, allow moisture buildup, or are too loose or too tight.

Education:

Meehan pointed out in 2000 that the "current" system of blame, shame and monetary penalties blocked effective communication on the topic, and had not resulted in decreased incidence or increased healing of pressure ulcers.[6] In 2007, Pieper noted that blame and money had still not worked; she suggested that instead, a team approach is needed.[4] The highly successful On-Time Quality Improvement for Long Term Care program facilitates rapid communication between certified nurse assistants (CNAs) and licensed care providers to provide an early warning system for increased pressure ulcer risk.[51,52] By creating a "culture of data", it achieved an average of a 33% reduction in pressure ulcer prevalence in 11 nursing homes the first year in which it was implemented.[51]

It is much easier to learn how to prevent a problem when one truly understands what causes it.[4] High pressure ulcer prevalence rates have been linked to poor knowledge.[5] Educational programs must involve all levels of health care personnel, along with at-risk individuals, their caregivers and other family members. Programs should include the cause of pressure ulcers, the significance of various contributing factors, preventive measures (including nutrition) and treatment rationale.[4,17,30,32] Teaching spinal cord injured patients self-care dramatically decreases their incidence of pressure ulcers. Extending pressure ulcer education to non-clinical personnel has improved outcomes; as these workers learned how their work directly impacts patients' health, they improved their service and alerted clinical staff to problems they identified.[53,54]

Guidelines and procedures can be highly effective tools.[17,21] One way to implement them is to create a multidisciplinary Skin Care Team made up of representatives from each nursing unit, surgery, dietary, home health, social services, physical therapy and radiology with a medical staff member as an advisor. These teams would be tasked with disseminating information and enthusiasm throughout a facility, evaluating and selecting cost-effective products, and gathering data and customizing policies.[17,21] Such teams have been able to implement risk-based prevention in care settings, reducing pressure ulcer incidence by over 50% while decreasing costs for pressure redistribution.[21]

The New Jersey Hospital Association (NJHA)'s Pressure Ulcer Collaborative achieved a 70% reduction in pressure ulcer incidence and a 30% reduction in pressure ulcer prevalence across 150 facilities of various types in less than two years.[15] The program emphasized changing the institutional culture to support pressure ulcer reduction.[15] Education programs and conference calls were also used to raise the knowledge level for the nurses involved in the collaborative program.[15] A list of websites for downloading education resources, most of which are free of charge, can be found at the end of this document. The 5 Million Lives Project includes special supplements for pediatric and rural settings.

Evaluation:

Incidence studies, which measure only the new cases of pressure ulcers, should be performed at regular intervals to evaluate the effectiveness of the pressure ulcer prevention program.[4,17] Prevalence studies measure the total number of pressure ulcers at a particular time, which helps to capture the effectiveness of treatment programs as well. These studies can assist in identifying problem areas so that action to improve them can be taken.[17] Guidelines and toolkits for monitoring pressure ulcer prevalence and incidence are included in the websites listed at the close of this document.

Treatment

The first evidence-based guidelines for pressure ulcer treatment were developed by the US government's Agency for Health Care Policy and Research (AHCPR, now called AHRQ) in December of 1994.[5,55] These guidelines, which have been modified over time, still provide the foundation for evidence-based pressure ulcer management.[5,41]

Addressing the Underlying Causes:

The existence of a pressure ulcer should trigger the implementation of the entire prevention section of this protocol with increased intensity to prevent further damage and facilitate wound healing.[4,5,14] When repositioning the patient, avoid putting pressure over the area of the wound as much as possible.[14,55] Low-air-loss beds improve pressure ulcer healing rates, except in spinal cord injured patients, who may be better off with a total contact seat.[56] Off-loading helps permit pressure ulcer healing, but continuous bed rest poses other significant health hazards, especially for spinal cord injured patients; it is therefore not an effective or appropriate component of long-term pressure ulcer treatment in these patients.[57,58] Encouraging spinal cord injured pressure ulcer patients to choose three one-hour intervals a day during which time they can sit up and participate in activities has proven to be an effective compromise.[58]

Assessment:

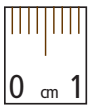
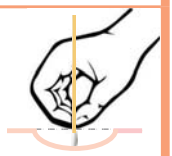
Underlying contributors to the pressure ulcer formation, such as medical conditions, incontinence, nutrition, pain and psychosocial health, must be effectively managed in order for a pressure ulcer to heal.[5] So, an individual with a pressure ulcer requires an initial complete health history and physical, not just a wound assessment.[13,59] Assessment of a patient with a pressure ulcer must include the wound's cause and duration, and factors that impede healing as well as the actual wound assessment.[4] Pressure ulcer treatment includes not only direct wound care (cleansing and debridement, controlling infections and dressings that promote a moist wound environment), but also aggressive nutritional support and pressure redistribution.[5] Hand washing is, of course, important to reduce the risk of infection.[47]

Pressure ulcers should be monitored by care providers with training in signs of improvement and deterioration at each dressing change. At least weekly, ulcers should be fully reassessed by a qualified health professional.[1,4,13,41] The weekly assessment (see accompanying Pressure Ulcer Pocket Guide for specific instructions) includes:[1,4]

- Anatomic location of the wound using the name of the relevant boney prominence[14,41]
- Stage or Grade of the ulcer[13,14,41]
- Size, with the dimensions of the wound in cm (length is longest initial dimension, width is perpendicular to length, depth at deepest point; tunneling (sinus tracts) and undermining length with position using a clock face as a reference, with towards the patient's head as 12 o'clock (i.e. 3.2 cm at 9:00).[5, 14, 41, 60]

- Type of tissue in the wound base as a percentage of the whole.[13,41] **Note:** Evaluating a tissue type by color alone is overly simplistic – not all red wound tissue is healthy granulation.[4,13,14]

Wound Assessment Guide

Parameter	Definitions and Descriptors Pick-List
Location*	**R** or **L** – patient's right or left **+ medial, lateral, proximal or distal** + boney prominence over which the ulcer formed **(ischial, trochanter, sacral, heel, malleolus, scapular, elbow, knee, occipital, iliac)**
Stage*	This describes the original extent of tissue loss. Slough indicates the injury is a Stage III or IV. Deep Tissue Injury (**DTI**), **I, II, III, IV** or **Unstageable**: See Pressure Ulcer Staging pp.10 -11
Size (measure wounds in cm) 	**Length** is the longest initial dimension and **width** is its longest perpendicular. **Depth** is the deepest point – measure with a cotton-tipped applicator, pinched at the depth of the skin. Using towards the head as 12 o'clock, record the **position and depth of any undermining and tunneling**. Measure depth using two side-by-side applicators: one inside and one outside. 
Tissue Type (as a percentage of the whole)	Necrotic (nonviable, devitalized tissue): is it **loosely** or **firmly adherent?** Eschar or Slough?
	Eschar: Black, brown, tan; Hard, soft, boggy | **Slough: White, yellow, tan, green; Soft, moist, stringy (fibrin), pulpy, mucoid**
	Clean avascular or **nongranulating:** pink or red, smooth without new growth. | **Blister** (bullae)
	Granulation: pink, red or dusky. **May be friable** (bleeds easily) or have **pocketing** (weak areas)
	Epithelialized: closed new skin where the wound once was: pink or white
Structures	Note any structures such as **bone, muscle fascia, tendon, or joint** as **visible** or **palpable**
Exudate (Drainage)	**Amount: none, scant, minimal, moderate, large, copious** - How long was the dressing in place? **Consistency: thick** (common in infection), **thin** (typical of autolytic debridement), **sticky, watery** **Type: serous (clear), serosanguineous (pink), bloody, purulent (yellow, tan, green)**
Odor	**Absent, faint, moderate, strong, sweet, foul** – dressings, diet, and hygiene also influence odor
Edges	**Margins attached and sloped** (healthy), **unattached (undermined), fibrotic (hard, hyperkeratotic), epibole (rolled** – scar has closed off edge, which will prevent cell migration**), scarred, callous**
Periwound (Surrounding skin)	**Texture: moist, dry, scaled, boggy, crepitus, indurated (hard), macerated** (swollen and wet), **denuded (weepy), edematous** (swollen: is it **pitting**?), **intact (normal), good turgor, tenting** **Color: erythema (reddened), pale Temperature: (warm, cool, hot).** If there is a **rash**, describe it.
Pain	**0 – 10** : Use the pain scales provided. Try to record pain at rest, pain with activity, and pain during dressing changes.

***Location and Stage are the same throughout the treatment and are repeated to identify the ulcer.**

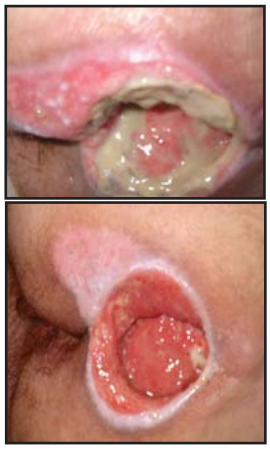
- Structures that are either visible or palpable (the ability to probe to bone suggests osteomyelitis)[4]
- Exudate (drainage) amount, consistency and type[13,41] Autolytic debridement should result in thin yellow or tan exudate.
- Odor[13] **Note:** all wounds have an odor, which is influenced by the type of dressing used, patient hygiene and presence of nonviable tissue.[14]
- Wound edges, or margins: presence of epibole (closed or rolled edges) vs. attached to the wound bed[13]
- Periwound (surrounding skin) condition – texture, color, temperature, any rash[13]
- Wound pain assessed with a pain scale. Scales with 0 – 10 should not be used to compare patients with one another but are very useful in noting improvement or worsening of pain for a given patient.[5]

The anatomic location and stage of the ulcer will not change over time, but should be included as a reference point on every weekly assessment report. Pain, financial burden, social isolation, functional status and other quality of life indicators are important aspects to include in any pressure ulcer treatment program evaluation and overall plan of care.[4]

Debridement and Wound Bed Cleansing:

Debridement of devitalized tissue from the wound bed is critical to achieve healing.[1,5,47] This can be performed mechanically, surgically, chemically, or through autolysis.[1,4,5,47]

Autolytic debridement is the debridement method most strongly associated with pressure ulcer healing.[61] Autolytic debridement uses the enzymes and white blood cells the body naturally sends into the wound bed to loosen and liquefy unhealthy tissue.[1,5] Moisture-retentive dressings are used to support an environment in which prolonged contact with wound fluid not only cleans the wound bed through autolytic debridement, but also provides the exposed healthy tissue with nutrients to help the wound heal.[1] In contrast to more aggressive forms of debridement, which may produce stress and anxiety, autolytic debridement is usually pain-free.[1] Autolytic debridement can be used for all wound types and is frequently the method of choice in home or long-term care settings.[1] Patients, family and staff must be taught in advance what to expect so that they do not misinterpret the results of the autolytic debridement process.[1,4] During autolysis, wound fluid will be increased and may have a color and odor similar to that of an infected wound.[1,4] The risk for infection is not, in fact, higher with autolysis than with other methods of debridement,[4] perhaps because neutrophils thrive in the moist wound bed.[62] If autolytic debridement is implemented, some improvement should be seen in 3 to 4 days.[4]



Only PolyMem was used for debridment

Autolytic debridement is a gradual process, so sometimes part of the devitalized tissue is removed with instruments or devices and autolytic debridement is used to provide the final wound bed clean up.[1] The only time autolytic debridement is definitely not appropriate is when a wound needs to be quickly and thoroughly cleaned out to prevent cellulitis or sepsis from spreading.[1,47] In these situations, surgical debridement should be performed by a qualified practitioner.[5,47] Pain associated with surgical debridement should be prevented through the use of appropriate analgesics.[47] Maggot debridement therapy is considered a last resort treatment when surgery is not feasible and conservative methods have been unsuccessful, and should be used only in the in-patient setting because of the risks of excessive bleeding.[63] The evidence base for maggot therapy is still very sparse, but studies indicate that patients with septic arthritis and older adults tend to respond poorly to it, and maggot therapy is often painful for non-diabetic patients.[63]

It is not generally appropriate to debride wounds on patients who are terminally ill or have insufficient arterial flow for healing.[7,47] Experts agree that one should not debride dry stable eschar on non-infected heels.[4,47,64] Wounds with dry eschar that are not debrided should be assessed daily.[47]

Initial wound cleansing should be as thorough as the patient's condition permits.[64] Showering is appropriate for pressure ulcer patients.[47] When wounds are irrigated, the cleansing fluid pressure should be between 4 and 15 psi and a surfactant-containing wound cleanser is recommended.[4,5,14] The Agency for Healthcare Research and Quality (AHCPR, now called AHRQ) and the Wound, Ostomy and Continence Nurses Society (WOCN) recommend pressure ulcers be cleansed at each dressing change.[64] PolyMem dressings release a surfactant and contain other components which work together to continually cleanse wounds, so the dressings themselves usually provide all the wound cleansing that a pressure ulcer patient needs during dressing changes.[65] Using a mild wound cleanser, rather than normal saline, on the periwound area has been shown to decrease microbial counts in the wound bed[66] and to promote pressure ulcer healing.[67] In an independent test of 20 wound and skin cleansing products, the non-toxic surfactant cleanser in PolyMem dressings was the least cytotoxic of all the products tested, out-performing even saline in preserving both fibroblast and keratinocyte cell viability.[5,68,69]

Pain Management:

Wound pain usually includes both persistent (background) pain and incident-related pain (from dressing changes, repositioning or debridement).[4] In one study, 84% of pressure ulcer patients reported wound pain at rest, and 88% of patients reported pain at dressing changes.[70] Patients with Stage IV pressure ulcers were slightly less likely to report pain, but when they did, the pain was most often excruciating.[70] Pressure ulcer pain is often constant.[70] Pain medications are seldom administered for chronic wounds, even before dressing changes.[70] Pain is not necessarily related to wound depth or size, but it usually decreases as the wound becomes cleaner and heals.[4,70] New pain may indicate a developing infection.[4] Spinal cord injured patients are not immune to wound pain; spasticity is a pain response in this population.[58,71]

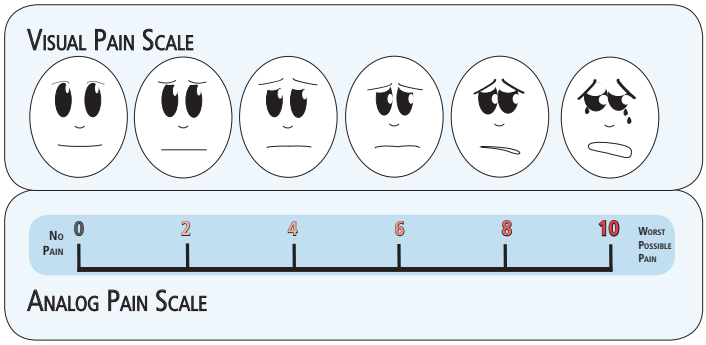
Wound pain is an important quality of life issue, but it also directly leads to wound hypoxia, which impairs healing and increases infection rates.[4] Uncontrolled pressure ulcer pain can limit a patient's ability to reposition, further increasing the risk of wound deterioration.[4,59,72] Long-term inadequately controlled nociceptive (acute) pain can lead to damage or malfunction of the nerve fibers, which causes a sensation (often burning pain or an electric-shock sensation) called neuropathic pain.[4,73] Chronic unrelieved wound pain can also lead to hyperalgesia (an exaggerated sense of pain) or even allodynia (pain caused by something that is not normally painful at all), which can make ordinary activities, like cleansing of the periwound skin, excruciatingly painful to the patient.[4,72,73] PolyMem dressings have been shown to reduce hyperalgesia at the application site.[74,75] Pain should be assessed consistently and reduced or eliminated in order to prevent nerve damage and enable the patient to be comfortable.[4]

Initially, a thorough pain history should be obtained to guide interventions.[4] Pain assessments should be performed at least daily, and should always be performed before, during and after dressing changes.[4] Daily pain assessments should include the quality, intensity, duration, and effect on the patient as well as the location of the pain (if possible, the patient should point to the precise spot of the most intense pain).[4,72] Pain intensity is best measured with a validated scale, such as the Numeric Pain Intensity Scale or the FACES Scale.[5] Patients who are unable to answer questions should be assessed using a tool such as the PAINAD scale or the Mahoney Pain Scale.[4,76] Pain intensity scales are used to assess whether a patient's pain is responding to interventions, not to compare the pain of one patient with that of another.[5] Achieving complete or almost complete pain relief for most wound patients is a reasonable, feasible goal.[4]

Medications are rarely benign.[4] If possible, pain should be managed by eliminating the source of the pain (cover wounds, adjust support surfaces, and reposition).[41] Pain-reducing dressings may reduce pressure ulcer pain more effectively than pharmacologic measures.[4] Good topical wound care can do much to prevent or minimize wound pain.[4] Care should be taken to minimize manipulation of the wound bed and not to allow drafts to cause wound pain at dressing changes.[4] The use of non-adherent dressings should be considered.[4,73] Allowing patients to perform their own dressing changes when possible may decrease their procedure-related wound pain.[4] Distraction techniques may also be beneficial.[4] Wound cleansing can be a source of significant wound pain.[4] Using autolysis for debridement is a good way to reduce procedure-related pain.[4] Negative pressure therapy is associated with increased pain.[4,73] Appropriate dressings can reduce wound pain by keeping wounds moist, protecting them from the environment, reducing inflammation and stimulating healing.[4,41] PolyMem dressings work to inhibit the nociceptor reaction at the application site, which often results in dramatic drug-free pain relief.[74,75,77] In some case studies, investigators have found PolyMem can also help decrease spasticity in spinal cord injured patients.[58]

A pressure ulcer is essentially an inflammatory lesion.[4,72] Inflammation releases chemicals in pressure ulcers that lower the nociceptor (pain) threshold.[72] Inflammation and edema contribute to background wound pain, so measures to reduce them should be a priority.[4] Elevation of the limb, systemic medications and compression bandaging or pumps are conventional methods for reducing edema.[4] PolyMem dressings can often reduce excess wound inflammation and edema by inhibiting the nociceptor response.[74,75,78]

When local measures are not able to eliminate or control the source of pain, analgesics should be provided as needed.[41] If opioids are used, patients should be given stool softeners as well.[4] Neuropathic pain often responds to antiseizure and antidepressant medications rather than opioids.[4]



Pain Assessment in Advanced Dementia (PAINAD) Scale

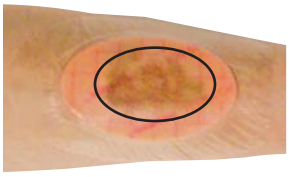
Items*	0	1	2	Score
Breathing independent of vocalization	Normal	Occasional labored breathing. Short period of hyperventilation.	Noisy labored breathing. Long period of hyperventilation. Cheyne-Stokes respirations.	
Negative vocalization	None	Occasional moan or groan. Low-level speech with a negative or disapproving quality.	Repeated trouble calling out. Loud moaning or groaning. Crying.	
Facial expressions	Smiling or	Sad. Frightened. Frown.	Facial grimacing.	
Body language	Relaxed	Tense. Distressed pacing. Fidgeting.	Rigid. Fists clenched. Knees pulled up. Pulling or pushing away. Striking out.	
Consolability	No need to console.	Distracted or reassured by voice or touch.	Unable to console, distract or reassure.	
			Total**	

* Five-item observational tool
** Total scores range from 0 to 10 (based on a scale of 0 to 2 for five items), with a higher score indicating more severe pain (0="no pain" to 10="severe pain").

Dressings:

Ulcers must be protected from contamination.[47] Sometimes wound dressings are removed daily to ensure that the pressure ulcer is not getting worse due to inadequate pressure relief.[47] But, frequent removal of dressings is not recommended due to the possibility of damaging the wound bed.[47] The use of evidence-based wound protocols will help avoid unnecessary dressing changes.[47] Dressings should keep the wound from becoming too cool, because temperatures below 36° C are associated with activation of an inhibitory substance in chronic wound fluid that adversely affects fibroblast activity.[79] Undermining, sinus tracts and dead space should be gently filled with absorbent materials.[40] Research supports the use of moist wound therapy to create a healing environment within the wound bed.[5,47] Using modern moist wound dressings is more cost-effective than using traditional dry or saline-soaked gauze dressings.[80,81] Even film food-wrap is superior to using gauze and conventional ointments in treating pressure ulcers.[82] Certain modern dressings often fail due to poor adhesion of the borders, allowing the wound to dry out.[83]

Chose a dressing that will absorb excess exudate, provide thermal insulation, allow gaseous exchange, protect the wound from contamination, maintain a moist wound environment, and relieve pain.[14] Basing wound dressing selection on dressing ingredients is problematic, because dressings within each category may be strikingly different with respect to their properties and efficacy.[84,85] PolyMem shares features of hydrocolloids, hydrogels and alginates, but it is classified on formularies as a foam dressing. PolyMem dressings should not be allowed to become completely saturated. They should be changed, at minimum, when the exudate visible through the clear semipermeable outer membrane reaches a wound edge. Changing the dressings more often is advisable to facilitate the removal of large quantities of slough.



When treatment of 18 stalled pressure ulcers in 13 elderly patients was switched to include PolyMem dressings, significant healing occurred in all but one patient (this patient was terminally ill).[65] The wound beds were kept moist without maceration, and eschar and necrotic tissue were dissolved or removed by the environment created by the dressing.[65] The use of PolyMem also resulted in a significant time savings, because the dressings were left on an average of 3.3 days, it was easy to see when the dressings needed to be changed and the wound beds were not cleansed manually at dressing changes.[65]

A randomized controlled study of healing Stage II pressure ulcers in patients over 65 years of age also showed that pressure ulcers covered with PolyMem dressings healed significantly faster than those covered with antibiotic ointment and clean gauze.[86] PolyMem dressings cleansed the wounds, wicked away exudate and protected the wounds, providing a warm moist environment.[86] It was postulated that the wound environment created by PolyMem dressings stimulates macrophages and increases the rate of angiogenesis.[86]

A search of independent in vitro tests for cytotoxicity should be done as part of the process of choosing dressings for a facility.[87] Alginate dressings with high calcium content impair cell proliferation.[87] Several other modern wound dressings have also been found to have cytotoxic ingredients.[87] PolyMem dressings contain a non-toxic cleanser[68,69] and the silver version demonstrated the least cytotoxicity of all the small-particle silver dressings tested.[88]

Evaluation:

Pressure ulcer healing can be evaluated using a validated instrument such as the PUSH tool or the PSST tool.[4,89] The PUSH tool was developed by the NPUAP based upon research showing that three parameters (surface area, surface appearance and exudate amount) best defined healing in pressure ulcers.[1] Wound assessment using this tool takes about 5 minutes for a trained clinician and the current version (3.0) has been shown to have excellent validity and responsiveness to change.[1,8] Reverse-staging ("down-staging") is not appropriate because the damaged tissue is replaced with scar tissue, not the same type of tissue that was lost when the wound formed.[4,5,8,89]

Among chronic wounds, pressure ulcers heal the slowest, with 2.156 mm of healing expected in 4 weeks.[5] Partial-thickness pressure ulcers (Stage I and II) should show evidence of healing within 1 – 2 weeks of initiation of treatment, and full-thickness pressure ulcers (Stage III and IV) should show a reduction in size within 2 – 4 weeks.[13,41] Most full-thickness ulcers can heal in 6 – 7 weeks, but mental alertness, mobility and nutrition dramatically influence healing time.[13] The time to heal a pressure ulcer depends upon many patient variables as well as the size and stage of the wound,[4] so it is difficult to draw conclusions about the efficacy of a treatment method based upon statistics alone. If the goal of care is healing and no progress is being made, reassess the overall plan and look for complications, such a squamous cell carcinoma or fluid collection in the soft tissues.[41] If ulcer healing does not progress, the entire care plan should be reevaluated;[13] do not assume the problem is the support surface,[1] or the current wound treatment plan.

Infection:

The most serious complication of pressure ulcers is sepsis.[18] Systemic response to infection such as cellulitis, leukocytosis or fever should lead to the prescription of systemic antibiotics for an effective but brief period.[4,47] Local signs of infection in a chronic wound include: strong odor, purulent exudate, induration, friable or discolored granulation tissue, pocketing of the wound base, increased pain, delayed healing.[4,47,49] Purulent material or foul odor should be addressed with more frequent cleansing and possibly debridement, but not

Pressure Ulcer Scale for Healing (PUSH) Tool 3.0

Length x Width (in cm²)	**0** 0	**1** < 0.3	**2** 0.3 - 0.6	**3** 0.7 - 1.0	**4** 1.1 - 2.0	**5** 2.1 - 3.0	**Sub-score**
		6 3.1 - 4.0	**7** 4.1 - 8.0	**8** 8.1 - 12.0	**9** 12.1 - 24.0	**10** > 24.0	
Exudate Amount	**0** None	**1** Light	**2** Moderate	**3** Heavy			**Sub-score**
Tissue Type	**0** Closed	**1** Epithelial Tissue	**2** Granulation Tissue	**3** Any Slough	**4** Any Necrotic Tissue		**Sub-score**
							TOTAL SCORE

systemic antibiotics.[47] Increasing signs of infection should be addressed with a quantitative swab culture using the Levine technique.[4,47,49] Before gathering a specimen using the Levine technique, cleanse the ulcer very thoroughly with warm non-bacteriostatic saline. Then, a swab should be rolled on its side for one full rotation in a 1.0 cm^2 granulating area of the ulcer with enough pressure to extract fluid from the tissues.[5,90]

If a wound deteriorates or is not improved after two weeks of appropriate care, the treatment should be re-evaluated.[49] If a clean-appearing wound is not healing despite four weeks of optimal wound care and patient management, a two week trial of topical antibiotics is appropriate to decrease bioburden.[1,14] Use of elemental antimicrobials that are released into the wound bed should be limited to 2 – 4 weeks.[4] In independent studies, modern dressings that release silver into the wound bed were found to be cytotoxic, but cells in contact with PolyMem Silver dressings proliferated.[87,88]

Studies of wound infection rates found decreases when pain was controlled, when patients were kept adequately warm, and when patients stopped smoking for at least 4 weeks.[4] Nicotine and carbon monoxide are potent vasoconstrictors; quitting smoking for 6 weeks improves healing and immune system function.[1] Immune function is impaired with malnutrition, as well.[91] The use of supplemental oxygen for prevention and treatment of systemic wound infection remains controversial.[4]

When clinical signs of infection do not respond to treatment, osteomyelitis and joint infection should be ruled out.[47] Approximately 20% - 25% of non-healing pressure ulcers have underlying osteomyelitis.[1,18] Osteomyelitis is difficult to diagnose in non-surgical settings.[4] MRIs are effective, but they are expensive and not used routinely; "probing to bone" is more commonly used in clinical settings and is also predictive of osteomyelitis.[4]

Adjunctive Therapies:

When following all recommendations fails to lead to pressure ulcer healing, adjunctive therapies should be considered.[5] Electrical stimulation seems to improve healing in Stage III and Stage IV pressure ulcers and should be tried on wounds that do not respond to traditional methods of healing.[5,40] Additional research needs to be done to learn the optimal electrical charge based upon the characteristics of the pressure ulcer.[5] Radiant heat (normothermia) seems to be beneficial for pressure ulcer healing, but more studies are needed.[5,79] Insufficient studies have been done to recommend growth factors and skin equivalents for pressure ulcer treatment, but growth factors show promise.[5] So far, studies have not shown that hyperbaric oxygen treatment is effective for uninfected pressure ulcers.[5,92] To date, study design flaws have rendered the results of trials on the use of topical negative pressure on pressure ulcers inconclusive.[40] The anti-hypertensive medication clonidine often increases perfusion and oxygenation in hypoxic wounds.[4]

Surgical Treatment Options:

Musculocutaneous or fasciocutaneous flap surgery can provide quick closure for Stage III and IV pressure ulcers, but both operative times and recovery times will be relatively long, so patients must be selected carefully.[1] The patient must be medically stable and compliant with off-loading.[1] A high level of post-operative care must be strictly maintained and the patient must be willing to make long-term commitment to protecting the area to avoid flap failure or pressure ulcer recurrence.[1,40] Direct closure, skin grafts and local flap grafts are not recommended for pressure ulcer closure due to their extremely high failure rates.[1]

Pressure Ulcer Dressing Selection Guide

After completing the patient and wound assessments, cleanse the wound bed according to your facility's protocol, and choose a wound dressing using the following algorithm.

Refer back to this algorithm at each dressing change. Sometimes it is beneficial to rinse the periwound area, but when PolyMem® dressings are used, they continuously cleanse the wound bed, so unless there is visible loose material or contamination in the wound bed, manually cleansing or rinsing the actual wound bed at dressing changes is unnecessary.

PolyMem promotes autolysis, which should produce increased thin yellow exudate and decreased slough within 3-4 days. Wounds with dry stable eschar suggest underlying circulatory problems. They should be left open to air and assessed daily. If the underlying cause is addressed, autolytic debridement with PolyMem becomes appropriate.

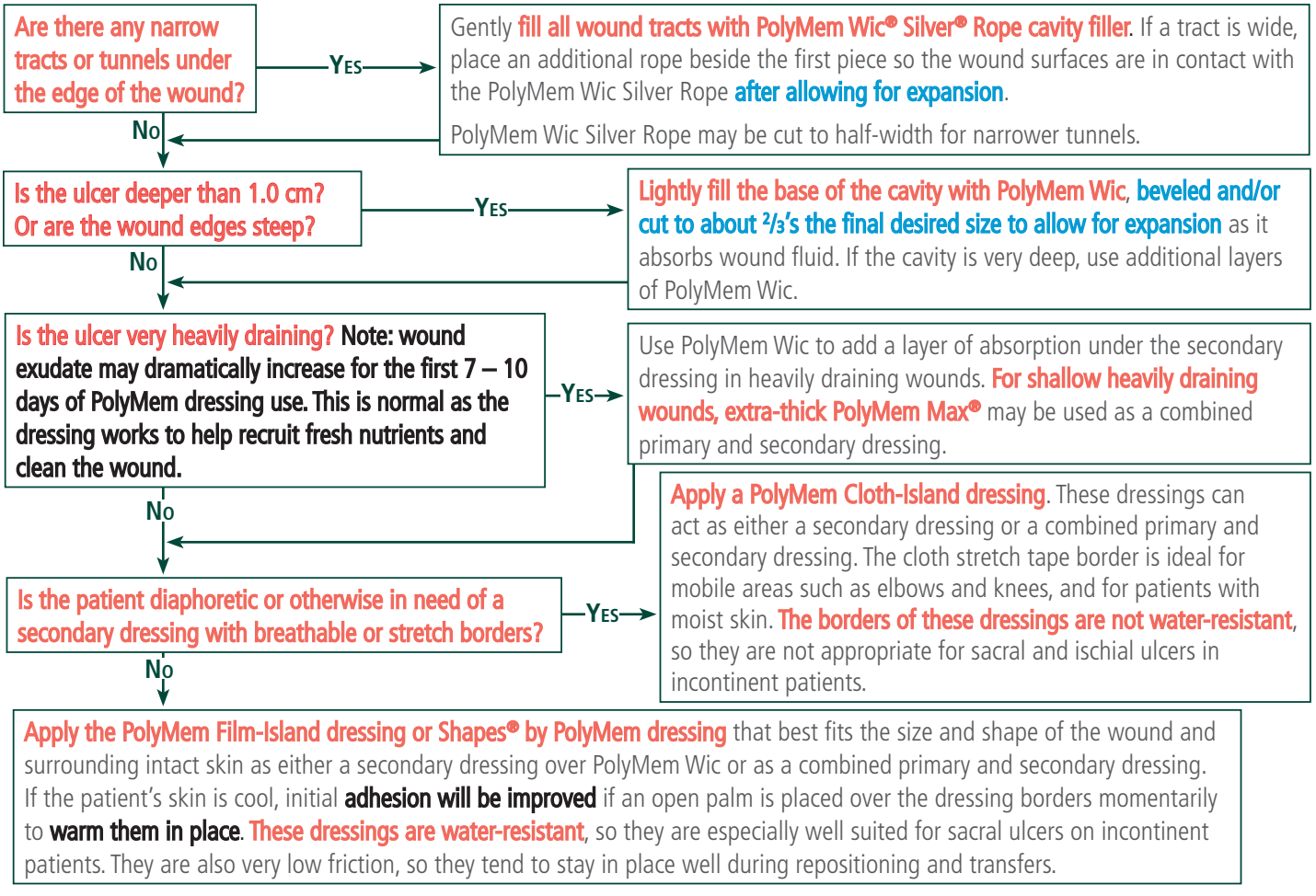
PolyMem dressings should maintain direct contact with the exposed surfaces of the wound, slough, or eschar in order to provide best results. PolyMem should also be in direct contact with as much of the periwound as possible.

PolyMem dressings are available in a variety of configurations that include adhesive cloth-backed dressings, adhesive film-backed dressings and pads without adhesive borders.

PolyMem dressing formulations are also available as primary dressings which are designated "WIC" dressings. **The PolyMem Wic® dressings will expand as wound fluid is absorbed. In order to allow for expansion cut the dressing 30% smaller than the wound when placing them in cavities or tunnels.**

PolyMem dressings are available with silver incorporated into the formulation for when antimicrobial benefits are desired. Silver dressings might be appropriate if the patient is 1) at high risk for infection due to medications, poor nutritional status, or other illnesses or 2) if there are signs of possible deep infection, such as thick foul drainage, reddened periwound, excessive drainage and swelling. Deep infections should also be addressed systemically.

Answer the following questions to choose the best dressing for the pressure ulcer:

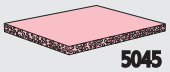


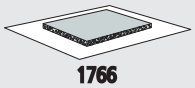
Products especially well suited for pressure ulcer care:

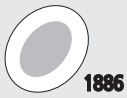

1814


5733


1333

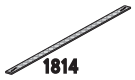

5045


1766


1886


3709

Cavity, Undermining, Tunneling Rope Dressing


1814

1814*† 0.4″ x 14.0″

Wic and Wic Silver Cavity Filler


5733

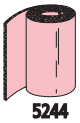
5733† 3.0″x 3.0″

Also available in:
1333*† 3.0″x 3.0″
5712 3.0″x 12.0″

Non-Adhesive Pad Dressing

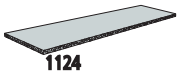

5033

5033 3.0″x 3.0″
5244 4.0″x 24.0″


5244

Also available in:
5044 4.0″x 4.0″
5055 5.0″x 5.0″
5077 6.5″x 7.5″
5124 4.0″x 12.5″

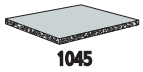
Non-Adhesive Silver Pad Dressing


1124

1124* 4.25″x 12.5″

Also available in:
1044* 4.25″x 4.25″
1077* 6.5″x 7.5″

Non-Adhesive Max and Max Silver Pad Dressing


1045

1045* 4.0″x 4.0″

Also available in:
5045† 4.5″x 4.5″
5088 8.0″x 8.0″
1088* 8.0″x 8.0″

Adhesive Cloth-Backed and Cloth-Backed Silver Dressings


7203

7203 2.0″x 2.0″ (1.0″x 1.0″ pad)
7031 1.0″x 3.0″ (1.0″x 1.0″ pad)


7031

Also available in:
7405 4.0″x 5.0″ (2.0″x 3.0″ pad)
7606 6.0″x 6.0″ (3.5″x 3.5″ pad)
7042 2.0″x 4.0″ (2.0″x 1.5″ pad)
1766*† 6.0″x 6.0″ (3.5″x 3.5″ pad)

Adhesive Oval-Shaped and Oval-Shaped Silver Film-Backed Dressings


8015


1823

8015 2.0″x 3.0″ (1.0″x 1.5″ pad)
1823* 2.0″x 3.0″ (1.0″x 2.0″ pad)

Also available in:
8023 2.0″x 3.0″ (1.0″x 2.0″ pad)
8053 5.0″x 3.5″ (3.0″x 2.0″ pad)
8086 6.5″x 8.2″ (4.0″x 5.7″ pad)
1815* 2.0″x 3.0″ (1.0″x 1.5″ pad)
1853* 5.0″x 3.5″ (3.0″x 2.0″ pad)
1886*† 6.5″x 8.2″ (4.0″x 5.7″ pad)

Adhesive Film-Backed Dressings


405

405 4.0″x 5.0″ (2.0″x 3.0″ pad)
3042 2.0″x 4.0″ (2.0″x 1.5″ pad)


3042

Also available in:
203 2.0″x 2.0″ (1.0″x 1.0″ pad)
606 6.0″x 6.0″ (3.5″x 3.5″ pad)
3031 1.0″x 3.0″ (1.0″x 1.0″ pad)
3412 4.0″x 12.5″ (2.0″x 10.0″ pad)

Adhesive Sacral and Sacral Silver Film-Backed Dressings


1709

1709* 7.2″x 7.8″ (4.5″x 4.7″ pad)

Also available in:
3709† 7.2″x 7.8″ (4.5″x 4.7″ pad)

Non-Adhesive Tube Dressing


5335

5335 3.5″ x 3.5″

3 & 4-digit numbers are reference numbers followed by the dimensions of available products
* *Reference numbers beginning with the "1" indicate silver dressings*
† *Included in "**Products especially well suited for pressure ulcer care**" box*

See Package Insert for complete instructions

Pressure Ulcer Treatment Protocol

(Text Summary)

I. Addressing the Underlying Causes:

The existence of a pressure ulcer should trigger the implementation of the entire prevention section of this protocol with increased intensity to prevent further damage and facilitate wound healing. Special attention should be given to

- managing incontinence and diaphoresis
- maintaining skin hygiene and moisture
- optimizing hydration and nutrition
- choosing appropriate support surfaces
- repositioning, avoiding friction and sheer

When repositioning the patient, avoid putting pressure over the area of the wound as much as possible. Spinal cord injured pressure ulcer patients need a total contact seat on which to sit for three one-hour intervals a day.

II. Assessment:

A. Perform an initial complete health history and physical, following up on deficits that can be corrected

B. Weekly wound assessments should include:

- **Anatomic location** of the wound
- **Stage or Grade** of the ulcer
- **Size** in centimeters, including any tunnels or tracts with locations
- **Type of tissue** in the wound base as a percentage of the whole
- **Exudate** amount, consistency and type
- **Odor**
- **Wound edges**, or margins: presence of epibole
- **Periwound** condition – texture, color, temperature, any rash
- **Wound pain** (both persistent and incident-related) assessed using a pain scale

Pain, financial burden, social isolation and functional status should be included in the treatment program evaluation and overall plan of care.

III. Debridement and Wound Bed Cleansing:

A. Initial Debridement

- Do not debride wounds on patients who are terminally ill or have insufficient arterial flow for healing, such as dry stable eschar on non-infected heels. Assess these wounds daily.
- If cellulitis or sepsis is present, immediate surgical debridement of eschar and slough is indicated.
- In all other cases, use moisture-retentive dressings to cleanse the wound bed through autolytic debridement. Improvement should be seen in 72 – 96 hours.

B. Cleansing

- Initial wound cleansing should be as thorough as the patient's condition permits. Ideally, wounds should be irrigated at 4 and 15 psi with a surfactant-containing wound cleanser.
- PolyMem dressings usually meet all subsequent wound cleansing needs. Obvious loose wound bed debris can be removed at dressing changes. Change dressings after showering to protect the wound.

IV. Pain Management:

Wound pain usually includes both persistent (background) pain and incident-related pain (from dressing changes, repositioning, debridement, etc.). New pain may indicate a developing infection.

- Manage pain by eliminating the source (cover wound, adjust support surfaces, reposition patient, etc).
- PolyMem dressings can often reduce excess wound inflammation and edema by inhibiting the nociceptor response. PolyMem can also often help decrease spasticity in spinal cord injured patients.
- When local measures are not able to eliminate or control the source of pain, analgesics should be provided as needed. If opioids are used patients should be given stool softeners as well. Neuropathic pain often responds to antiseizure and antidepressant medications rather than opioids.

V. Dressings:

- Dressings should absorb excess exudate, fill dead space, maintain a moist wound environment, allow gaseous exchange, provide thermal insulation, protect the wound from contamination and relieve pain.
- Dressings can be chosen using the accompanying Pressure Ulcer Dressing Selection Guide.
- PolyMem dressings should be changed, at minimum, when the exudate visible through the clear semipermeable outer membrane reaches the approximate wound edge (this can be drawn on the top of the dressing). Changing the dressings more often is advisable to facilitate the removal of large quantities of slough. When PolyMem dressings are used, dressing changes do not usually include additional wound bed cleansing or rinsing.

VI. Evaluation:

- Evaluate pressure ulcer healing using a validated tool such as the PUSH tool or the PSST tool.
- Reverse-staging ("down-staging") is not appropriate because the damaged tissue is replaced with scar tissue, not the same type of tissue that was lost when the wound formed.
- Partial-thickness pressure ulcers (Stage I and II) should show evidence of healing within 1 – 2 weeks.
- Full-thickness pressure ulcers (Stage III and IV) should show a reduction in size within 2 – 4 weeks.
- If the goal of care is healing and no progress is being made after two weeks of appropriate care, reassess the overall plan and look for complications, such as infection, squamous cell carcinoma or fluid collection in the soft tissues.

VII. Infection:

- Local signs of infection in a chronic wound include: strong odor, purulent exudate, induration, friable or discolored granulation tissue, pocketing of the wound base, increased pain and/or delayed healing.[88]
- If a clean-appearing wound is not healing despite four weeks of optimal wound care and patient management, a two week trial of a topical antimicrobial is appropriate. An independent study shows PolyMem Silver dressings are a tissue-friendly dressing that incorporates antimicrobial benefits.
- A quantitative swab culture using the Levine technique should be obtained if signs of infection increase.
- Systemic response to infection such as cellulitis, leukocytosis or fever should lead to the prescription of systemic antibiotics for an effective but brief period.
- When clinical signs of infection do not respond to treatment, osteomyelitis and joint infection should be ruled out.

VIII. Adjunctive Therapies:

When following all recommendations fails to lead to pressure ulcer healing, consider adding:

- Electrical stimulation in Stage III and Stage IV pressure ulcers
- Clonidine, which often increases perfusion and oxygenation in hypoxic wounds.

IX. Surgical Treatment Options:

- Direct closure, skin grafts and local flap grafts are not recommended for pressure ulcer closure due to their extremely high failure rates.
- Musculocutaneous or fasciocutaneous flap surgery can provide quick closure for Stage III and IV pressure ulcers, but the patient must be medically stable and compliant with off-loading.

Pressure Ulcer Treatment Procedure

(After Initial Cleansing And Debridement)

Goal: The desired outcome of this procedure is to maximize healing while minimizing recurrence, complications and pain associated with pressure ulcers. Interim goals include: reducing slough and odor; decreasing pain, edema and erythema; increasing convenience to the patient; and facilitating wound closure by improving systemic factors to promote wound healing and providing a wound environment conducive to healing.

Implementation of the complete pressure ulcer protocol should result in significant cost savings due to a diminished pressure ulcer incidence and shorter treatment times. Treatment costs should also be reduced.

Equipment:

- Clean gloves
- Impervious disposable bag
- Disposable ruler and 2 soft-tipped applicators for gauging the depth of cavities, tunnels and/or sinus tracts.
- System for tracing the wound and/or a digital camera, depending upon facility documentation standards
- PolyMem, PolyMem Max and/or PolyMem Wic Wound Dressing (standard or PolyMem Silver)
- PolyMem Wic Silver Rope cavity filler if the wound includes any tunnels, fistulas or sinus tracts.

PROCEDURE	RATIONALE/EMPHASIS
I. Uncover: Assess for persistent wound pain. Enquire regularly about procedural pain throughout the dressing change. Put on gloves. Remove the wound dressing and dispose of the soiled disposable materials appropriately.	**I.** Pre-medication for pain prior to dressing changes is rarely needed,* because PolyMem dressings contain a moisturizer and are non-adherent to the wound surface, reducing the risk of disrupting healing tissues during dressing changes.
II. Assess: At least once a week, thoroughly assess all pressure ulcer parameters, including both persistent and procedural pain. Measure, trace and/or photograph wounds according to facility documentation standards. Use cotton-tipped applicators to measure the depth of any undermining, sinus tracts, fistulas, tunnels and cavities.	**II.** Assessment is essential for both documentation and follow-up. Most patients experience dramatic persistent and procedural pain relief with PolyMem dressings. Expect quick formation of granulation tissue and a steady decrease in wound bed size.
III. Fill any sinus tracts, fistulas or tunnels with PolyMem Wic Silver Rope cavity filler. Fill undermining and cavities with layers of PolyMem Wic or PolyMem Wic Silver bevel-cut to $^{2}/_{3}^{rds}$ the diameter and depth of the wound to allow for expansion as the dressings absorb exudate.	**III.** PolyMem Wic Silver Rope slides easily in and out of narrow wound spaces completely intact. PolyMem Wic and PolyMem Wic Silver have no membrane to limit their expansion, so cutting them smaller than the wound size and with a bevel is a prudent precaution to prevent risk of undue pressure on the wound edges from their expansion as they absorb exudate.
IV. Cover the wound with an appropriate PolyMem secondary dressing (see Pressure Ulcer dressing selection guide). Cloth bordered PolyMem dressings are ideal for diaphoretic patients. Shapes by PolyMem bordered dressings are water-resistant, which is important for patients with incontinence. Substitute PolyMem Silver for the standard pink dressings when antimicrobial effects are desired.	**IV.** With the PolyMem formulation, the dressing change process is simple – just remove the old dressings and place new dressings in and on the wound. No wound bed rinsing is routinely performed during the dressing change process because PolyMem dressings provide continuous cleansing of the wound. PolyMem absorbs up to ten times its weight in exudate, decreasing the risk of maceration.
V. Assess for causes of delayed healing such as inadequate pressure redistribution, nutritional deficits or infection and implement recommended interventions for these problems, using Ferris' pressure ulcer educational material.	**V.** Patients who adhere to treatment protocols usually experience a steady decrease in wound slough and wound size. Poor nutrition, inadequate pressure redistribution and infection are the most common reasons for non-healing in pressure ulcers.
VI. Follow-up: If the wound is not significantly cleaner and/ or smaller after four weeks of optimal wound care and patient management, a two week trial of antimicrobial PolyMem Silver is warranted. If there is still no improvement, the patient should be evaluated for potential osteomyelitis. If the wound appears hypoxic, clonidine may be beneficial. Electrical stimulation can also be attempted.	**VI.** Infection is a common cause of poor pressure ulcer healing. ~20% - 25% of non-healing pressure ulcers have underlying osteomyelitis. Clonidine and electrical stimulation are the two adjunctive therapies with solid evidence showing effectiveness.
VII. Document wound location, stage or grade, dimensions, type of tissue, exudate, odor, wound edges, periwound condition, persistent and dressing change wound pain, dressings used, teaching, and proposed intervention strategies such as pressure redistribution devices.	**VII.** Comprehensive documentation allows other clinicians to quickly determine appropriate interventions for the patient, enhancing the quality of care provided.

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* Occasionally a patient may experience discomfort upon application of PolyMem due to the dramatic pulling of the exudate from the wound. This discomfort, which rarely occurs after the first few dressing changes, can easily be prevented by dripping saline onto the wound bed and then applying the PolyMem dressing onto this wet surface.

Printable tools, brochures & educational websites:

(NOT A PART OF THE PROTOCOL)

1. WOCN: Prevalence and Incidence: A Toolkit for Clinicians uses Pressure Ulcers as the example.
2. EPUAP's guidelines for monitoring prevalence and incidence
   - http://www.epuap.org/review4_1/page6.html
3. Patient handout from RNAO:
   - http://www.rnao.org/Storage/11/553_Press_Ulcer_Fact_Sheet.pdf
4. NPUAP/ADA PU-specific nutrition recommendations
   - http://www.eatright.org/ada/files/242_Pressure_ulcer.pdf
5. A video is available for teaching the use of the Braden Scale at
   - http://www.bradenscale.com/products.htm
6. Health Quality Institute pressure ulcer prevention and treatment tools for long term care facilities
   - http://nursinghomes. tmf.org/Portals/16/Documents/NH/Toolkits/PU/Pressur%20Ulce%20Toolkit.pdf
7. New Jersey Collaborative
   - http://www.njha.com/qualityinstitute/ulcer.aspx
8. Minnesota Hospital Association
   - http://www.mnhospitals.org/index/tools-app/tool.353?view=detail
9. Borun Center and UCLA Pressure Ulcer Prevention Training Module (very comprehensive)
   - http://www.geronet.med.ucla.edu/centers/borun/modules/Pressure_ulcer_prevention/default.htm
10. 5 Million Lives Campaign
    - http://www.ihi.org/IHI/Programs/Campaign/PressureUlcers.htm
11. The EPUAP pressure ulcer staging competency learning module for clinicians.
    - http://www.epuap.org/puclas/
12. http://www.guideline.gov/summary/summary.aspx?doc_id=3511
13. http://www.ndhcri.org/Tools/Treatment_Product_Categories_with_Brands.pdf
14. On-Time Quality Improvement for Long-Term Care
    - http://www.ahrq.gov/research/ontime.htm
15. NPUAP prevention curriculum
    - http://www.npuap.org/PDF/prevcurr.pdf
16. NPUAP Pressure Ulcer Prevention Points
    - http://www.npuap.org/PU_Prev_Points.pdf
17. NPUAP treatment curriculum
    - http://www.npuap.org/PDF/treatment_curriculum.pdf
18. Louisiana Health Care Review (excellent: skin care fair, etc)
    - http://www.lhcr.org/html/providers/NHResources.htm#PU
19. North Dakota Health Care Review:
    - http://www.ndhcri.org/Tools/Pressure_Ulcer_Tool_Kit.pdf
20. Illinois Foundation for Quality Health Care:
    - http://www.ifqhc.org/provider/patientsafety/pro_patientsafety_resources.html#PrU

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