Treating Pressure Injuries and Chronic Wounds

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- Read the enclosed course.
- Complete the questions at the end of the course.
- Return your completed Evaluation to NetCE by mail or fax, or complete online at www.NetCE.com. (If you are a Florida nurse, please return the included Answer Sheet/Evaluation.) Your postmark or facsimile date will be used as your completion date.
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Faculty

Maryam Mamou, BSN, RN, CRRN, CWOCN, is an Irish-trained RN who has lived and worked in the United States for 20 years. During her career, she has completed a BSN and went on to become a certified rehabilitation nurse, a certified life care planner, and more recently a certified wound ostomy and continence nurse. She is a graduate of the wound ostomy and continence program at Emory University in Atlanta, Georgia, and is nationally certified in these areas.

Ms. Mamou has worked in various rehabilitation settings and has first-hand experience of how pressure ulcers impact patients' recovery and quality of life. She has held positions as staff nurse, unit coordinator, educator, and director of nursing in home health care. She has been involved in developing and implementing several staff education programs in a variety of settings. She was most recently employed as a wound ostomy and continence nurse at East Alabama Medical Center in Opelika, Alabama.

Faculty Disclosure

Contributing faculty, Maryam Mamou, BSN, RN, CRRN, CWOCN, has disclosed no relevant financial relationship with any product manufacturer or service provider mentioned.

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Division Planner/Director Disclosure

The division planner and director have disclosed no relevant financial relationship with any product manufacturer or service provider mentioned.

Audience

This course is designed for nurses in all care settings who may care for patients with pressure injuries or chronic wounds.

Accreditations & Approvals

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Course Objective

The purpose of this course is to provide nurses with information about the process of wound healing and interventions that may advance or hinder it in order to support the use of evidence-based practice and improve patient health.

Learning Objectives

Upon completion of this course, you should be able to:

1. Describe pressure injuries and ulcers and how they develop.
2. Accurately identify pressure injury stages.
3. List key points of patient history and physical examination, and describe how the different body systems impact pressure injury development and healing.
4. Perform a comprehensive wound assessment.
5. Discuss the stages of wound healing.
6. Describe the different approaches to wound debridement and cleansing.
7. List the different types of dressing materials available for wound care.
8. Outline the necessary components of evaluating and monitoring wound healing.

EVIDENCE-BASED PRACTICE RECOMMENDATION

Sections marked with this symbol include evidence-based practice recommendations. The level of evidence and/or strength of recommendation, as provided by the evidence-based source, are also included so you may determine the validity or relevance of the information. These sections may be used in conjunction with the course material for better application to your daily practice.

INTRODUCTION

Implementation of early, state-of-the-art treatment is the key to effectively treating pressure ulcers and chronic wounds. However, this treatment must be holistic in its approach and take into consideration the patient's medical condition and the patient's/family's long-term goals. Pressure injury management should incorporate comprehensive, holistic care so that all factors that contribute to the development and progress or lack of progress of the wound are equally addressed. The diagnosis and management of the wound should be seen in the context of the whole person.

Studies have shown that the most effective model for wound care management is a multidisciplinary team approach. Ideally, the team should include all disciplines with a role in promoting wound healing, including physicians, certified wound care nurses, nursing staff, physical therapists, dieticians, occupational therapists, social workers, utilization review specialists, and speech therapists [1]. In this team effort, nursing staff of all levels play an important and decisive role in wound treatment. However, it can be a daunting task for any nurse to be part of the decision-making process responsible for determining the wound care modality best suited to meet the needs of the patient. This course will provide the information necessary to properly treat various types of pressure ulcers and wounds effectively and completely.

As a result of the National Pressure Ulcer Advisory Panel (NPUAP) 2016 Staging Consensus Conference, the terminology changed from "pressure ulcer" to "pressure injury" to more accurately describe pressure injuries to both intact and ulcerated skin [2]. The staging system for pressure ulcers was also updated to clarify the definitions of various stages and reduce confusion [3]. In 2019, the Advisory Panel announced a name change from NPUAP to National Pressure Injury Advisory Panel (NPIAP) to adopt the internationally preferred term of "pressure injury" in place of "pressure ulcer" [4]. For the purpose of this course, the terms "pressure ulcer" and "pressure injury" are used interchangeably, except in defining and staging injury.

AN OVERVIEW OF PRESSURE INJURIES

According to the 2019 NPIAP guideline, pressure injuries are localized areas of injury to the skin or underlying soft tissue caused by sustained pressure or pressure in combination with shear or friction, including those related to a medical or other device. The tolerance of soft tissue for pressure and shear may also be affected by microclimate, nutrition, perfusion, comorbidities, and condition of the tissue. The injury can present as intact skin or an open ulcer and may be painful. Pressure injuries commonly develop in association with debilitating illness and injury that lead to immobility and gravity-dependent pressure over boney prominences, such as the sacrum, hip, heel, or ankle [1; 3].

A pressure ulcer may also be referred to as a pressure injury, pressure sore, a bed sore, a dermal ulcer, or a decubitus ulcer. The ulceration is caused by compression of the soft tissue between two hard surfaces—the bone surface internally and the rigid surface of a bed, chair, or splint externally. According to the Centers for Medicare and Medicaid Services (CMS) guideline, a pressure ulcer can develop in at-risk patients within two to six hours of the onset of pressure [5]. Pressure ulcers can occur in all healthcare settings and affect all age groups. No healthcare specialty is immune from having a patient who will develop pressure ulcers [6]. The skin is the largest organ in the body, and preserving its integrity depends on the other organ systems for circulation, nutrition, and immune function.

The study of pressure ulcers began in recent times, although historical evidence suggests that wound problems have existed throughout humanity [7]. The oldest written documentation of wound management is from around 1500 B.C.E., in studies of ancient Egyptian medicine. These scripts show that Egyptians used oiled frog skins, honey, lint, and animal grease for wound care [7]. Attention to pressure ulcer prevention and treatment has grown in recent years, starting in the 1990s. Historically, pressure ulcers were regarded as a nursing problem, but they are now recognized to be the result of deficits at multiple points of care [7].

An estimated 95% of pressure injuries occur on the lower part of the body, with approximately 70% in the hip and buttocks area and 15% to 25% in the lower extremities [8]. There is a two to six times greater mortality risk for patients who develop pressure ulcers [8; 9]. In acute care hospitals, patient risk for acquiring a pressure injury is estimated to range from 2.7% to 29% [1; 8].

Pressure injuries are one of the most recurrent medical complications of spinal cord injuries (SCIs). According to the 2023 report of the National Spinal Cord Injury Statistical Center, 25.2% of patients with SCI reported pressure injury in the first year since discharge from rehabilitation, 30% reported pressure injury in the 20 years following SCI, and 36% reported pressure injury in the 40 years following SCI [10].

The recurrence rate, or the number of patients who have had a pressure ulcer and develop another one, is highly debatable due to a lack of standardized nomenclature. One estimate for pressure ulcer recurrence ranges between 5% and 41%; another source indicates recurrence rates between 40% and 80%. Although rates are considered highly variable, all patients with existing pressure ulcers are considered at high risk for developing additional ulcers, regardless of the clinical setting [11].

NPIAP PRESSURE INJURY STAGING

In 2014, the NPUAP (now the NPIAP) and the European Pressure Ulcer Advisory Panel (EPUAP) developed a common international definition and description system for pressure ulcers. As noted, the NPUAP further revised some of these definitions and staging efforts to reduce confusion and clarify terminology in 2019. The revised NPIAP guidelines for staging a pressure injury are [2; 6]:

- Stage 1 Pressure Injury—Nonblanchable erythema of intact skin: Intact skin with a localized area of nonblanchable erythema. Presence of blanchable erythema or changes in sensation, temperature, or firmness may precede visual changes. Color changes do not include maroon or purple discoloration, as this may indicate deep pressure injury. Changes may appear differently in darkly pigmented skin.
- Stage 2 Pressure Injury—Partial-thickness skin loss with exposed dermis: The wound bed is viable, pink or red, moist, and may also present as an intact or ruptured serum-filled blister. Adipose and deeper tissues are not visible. Granulation tissue, slough, and eschar are not present. These injuries commonly result from adverse microclimate and shear in the skin over the pelvis and shear in the heel. This stage should not be used to describe moisture-associated skin damage, including incontinence-associated dermatitis, intertriginous dermatitis, medical adhesive-related skin injury, or traumatic wounds (e.g., skin tears, burns, abrasions).
- Stage 3 Pressure Injury—Full-thickness skin loss: These wounds display full-thickness skin loss with adipose visible in the ulcer and granulation tissue and epibole (rolled wound edges) often present. Slough and/or eschar may be visible. The depth of tissue damage varies by anatomic location; areas of significant adiposity can develop deep wounds. Undermining and tunneling may occur. Fascia, muscle, tendon, ligament, cartilage, and/or bone are not exposed. If slough or eschar obscures the extent of tissue loss, it is considered an unstageable pressure injury.
- Stage 4 Pressure Injury—Full-thickness skin and tissue loss: Wounds of this stage have full-thickness skin and tissue loss, with exposed or directly palpable fascia, tendon, muscle, ligament, cartilage, or bone, often with sloughing or eschar on the wound bed and epibole, undermining, tunneling, and fistula formation. Depth varies by anatomic location. If slough or eschar obscures the extent of tissue loss, it is considered an unstageable pressure injury.

- Unstageable Pressure Injury—Full thickness skin and tissue loss in which the extent of tissue damage within the ulcer cannot be confirmed because it is completely covered by slough and/or eschar. If slough or eschar is removed, a stage 3 or stage 4 pressure injury will be revealed. Stable eschar (i.e., dry, adherent, intact without erythema or fluctuance) on the heel or ischemic limb should not be softened or removed.
- Deep Tissue Pressure Injury—Persistent non-blanchable deep red, maroon, or purple discoloration: This wound is characterized by intact or non-intact skin with localized area of persistent non-blanchable deep red, maroon, or purple discoloration or epidermal separation revealing a dark wound bed or blood-filled blister. Pain and temperature change often precede skin color changes. Discoloration may appear differently in darkly pigmented skin. This injury results from intense and/or prolonged pressure and shear forces at the bone-muscle interface. The wound may evolve rapidly to reveal the actual extent of tissue injury or may resolve without tissue loss. If necrotic tissue, subcutaneous tissue, granulation tissue, fascia, muscle, or other underlying structures are visible, this indicates a full thickness pressure injury (Unstageable, stage 3, or stage 4). This term does not describe vascular, traumatic, neuropathic, or dermatologic conditions.

In addition to the revised staging definitions, the NPIAP Consensus Conference members agreed upon two new pressure injury definitions [2]:

- Medical device-related pressure injury: Medical device-related pressure injuries result from the use of devices designed and applied for diagnostic or therapeutic purposes. The resultant pressure injury generally conforms to the pattern or shape of the device. This term refers to etiology; the injury should be staged using the staging system.
- Mucosal membrane pressure injury: Mucosal membrane pressure injuries are found on mucous membranes with a history of a medical device use at the anatomic location. Due to the anatomy of the tissue, these injuries cannot be staged.

PATIENT ASSESSMENT

Assessment is the first and most critical step in wound care. It is important to keep in mind that treatment plans are based on the findings from the assessment, and one of the major goals is to prevent undirected and inappropriate care [9].

The two parts of the assessment are the physical examination and data collection, which includes past and present medical history, social environment, educational needs, and cultural norms [8; 9]. These two components will enable the clinician to obtain an overall view of the patient's current health status [12].

PATIENT HISTORY AND DATA COLLECTION

A detailed history is usually gathered during an interview with the patient, significant others, family, caregivers, and other healthcare professionals involved in the patient's care. If a patient is admitted from another facility, it may be necessary to speak with the nursing staff at that facility in addition to reviewing the medical record.

The patient interview should be conducted in a private, quiet area and in an unhurried manner. One goal of the interview process is to begin to develop the therapeutic relationship with patients and those who are important in their care. The interview should not be merely a series of questions but should also include active listening and observation [9].

Health habits should be evaluated, including determination of how active the patient is, daily routines, diet, and sleep habits. Smoking, alcohol use, and illicit drug abuse can impair tissue profusion and delay wound healing [8; 9].

A medication profile should be obtained, including prescription and over-the-counter medications. Certain medications will interfere with wound healing or interact with wound treatments [8; 9]. For example, anti-inflammatory drugs can prolong the inflammatory phase of wound healing [12].

It is important to include a list of allergies in the medical history. For patients with latex allergy, wound care products that contain latex cannot be used. Sulfonamide antibiotics are common allergens, and silver sulfadiazine is a frequently used topical wound application. Before attempting any pharmacotherapy, the clinician must be aware of the patient's allergy history [9].

Social Environment

The patient should be evaluated within the context of his or her support system [8; 9]. The strength or weakness of the support system will help determine the structure of the ongoing wound care plan. For example, is there someone who is willing to learn how to change dressings and perform procedures if the patient is discharged home? Is there someone available to take the patient to an outpatient wound treatment center after discharge? It is vital to determine which type of wound care is the safest, most efficient, and most cost effective for the patient and family and to evaluate the optimum environment in which to deliver this care [13].

Consequences of the wound for the patient and significant other/family must also be assessed. Pressure ulcers have profound effects on the quality of life for patients and many times for caregivers also. Studies show that the psychologic impact of ulcers is greater among younger patients [13].

Caregiver guilt associated with the development of a pressure ulcer is common, and healthcare professionals should be aware of their own preconceptions related to pressure ulcers. Nonverbal responses, such as facial expressions, may be more important than the words that are said. Patient and family reports suggest that, in many instances, healthcare professionals regard pressure ulcers as a sign of neglect. In reality, most caregivers are family members willing to take on the responsibility but with little or no training or preparation for the role. The emotional response of the patient and family to a pressure ulcer may range from anger, embarrassment, and shame to guilt and powerlessness [13].

The physical environment in the home setting must also be considered, especially if the patient will require the services of home health care to continue wound treatment postdischarge. Part of the assessment should include discussion of where the patient lives and if all the basic services are available to them after discharge, such as running water. If there is a lack of service for utilities and electricity, a social worker is an invaluable resource. It is important to recognize that these are issues that must be addressed from the moment of admission and not left until discharge is imminent. A patient with a poor or nonexistent support network or a challenging living environment will require a more in-depth discharge plan to ensure that the goals of wound treatment are met [9].

Educational Needs

Ascertaining the patient's educational status and ability to learn and retain new information is essential to the plan of care. Most of this information can be gathered by direct, nonthreatening questions, such as "What grade did you complete in school?" This simple question can elicit a direct answer and further information about the patient's level of education, literacy level, and language preferences. Knowledge of the significant other's/caregiver's level of education and comprehension is also important, especially for cognitively impaired or dependent patients.

In the clinical setting, the questions most frequently asked by patients and their families regarding wound care are [13]:

- Will the wound heal?
- How long will it take to heal?
- Will the treatment cause pain?

Both the patient's and the family's learning style should be assessed, including current understanding of wound prevention and wound care. Misconceptions may be addressed in a nonconfrontational manner. Many beliefs about appropriate wound care interventions are rooted in treatment modalities that were popular in the past. The clinician should be aware of current evidence-based practices and be able to explain them in simple, clear terms.

Finally, the patient's cognitive status should be assessed, including comorbidities that would adversely affect the patient's ability to care for him- or herself. For example, a patient who has experienced a cerebrovascular accident may have difficulties processing and retaining new information. The patient's coping patterns and willingness or ability to comply with treatment should be taken into consideration. Common issues that should be addressed are feelings of hopelessness, despair, depression, and anger. If any of these factors are present, referral to a mental health professional is advised.

Cultural Norms

In our multicultural society, patients have diverse healthcare beliefs, lifestyles, and practices. Respect for these differences is necessary for all healthcare providers. During the patient history, information should be gathered regarding the patient's and family's beliefs about health and wellness. If these beliefs are unknown, goals may be set that are not in keeping with the patient's priorities.

PHYSICAL EXAMINATION

The physical examination will include a systems review, and the clinician must assess how impairments in any body system will impact wound healing and help shape the plan of care [8]. Comorbid conditions play a part in this assessment. Diabetes and obesity, specifically, affect a large number of patients and can result in devastating impairment in wound healing.

Respiratory System

Many respiratory problems can lead to wound development, slow the process of wound healing, and require special wound care interventions. The respiratory system is partially responsible for delivering oxygen and nutrients to the tissues, both of which are necessary for wound healing.

Many patients with asthma require steroid therapy to control and relieve symptoms, and it is not unusual for individuals with asthma to have a prolonged history of steroid use [9]. While steroids are effective in suppressing the inflammation responsible for asthma attacks, they also block the inflammatory phase of wound healing, which is essential to wound resolution [9]. Oral or topical vitamin A may be used to decrease the anti-inflammatory effects of steroids; consultation with the treating physician on an individual basis for the possible use of vitamin A in the wound treatment plan of care is recommended [14].

Cardiovascular System

Patients with heart disease tend to have impaired pumping capacity, and all body tissues will suffer as a result of this. In patients with any cardiovascular disease, such as congestive heart failure and coronary artery disease, wound healing will be problematic [9].

Musculoskeletal and Neurologic Systems

Patients who have impaired movement in any part of their body are at high risk for pressure ulcer development [9]. This includes those with cerebrovascular accident, spinal cord injuries, multiple sclerosis, Parkinson disease, and arthritis [8; 9]. These conditions can severely limit mobility (a risk factor for wound development) and make positioning for wound care difficult.

Gastrointestinal System

Gastrointestinal diseases that lead to poor digestion and malabsorption of nutrients will have a negative impact on wound healing [9]. Patients receiving enteral feedings via gastrostomy tubes frequently have loose stools, which can cause wound contamination. A dietician can make recommendations for altering the consistency of the existing formula or changing to another product. A key consideration for patients with diarrhea is the use of dressings that protect the wound from fecal contamination [9].

Genitourinary System

Approximately 10 to 13 million Americans are troubled with either transient or chronic urinary incontinence [15]. Urinary incontinence will lead to maceration (water logging) of the skin, potentiating the risk for further skin breakdown and contamination of existing wounds [9].

NUTRITIONAL ASSESSMENT

A full nutritional assessment and plan, preferably in consultation with a nutritionist, is an important part of wound care, as nutritionally compromised patients have greater difficulty achieving wound healing. The goal is to characterize the patient's current nutritional state, identify changes that have occurred in recent months or weeks, and predict the impact on the patient's overall functional level and prognosis for healing. This assessment should include protein and calorie intake, hydration status, and the measure of serum albumin and/or proalbumin. Dehydration impairs wound healing by decreasing the blood volume available to transport oxygen and nutrients to healing wounds [9].

Once the patient's nutritional needs and functional status have been clarified, an appropriate plan of care can be devised to ensure adequate nutritional and fluid intake. For some patients with late-stage pressure ulcers and documented nutritional deficiencies, a brief period of enteral or parenteral supplementation may be advisable, keeping in mind that the patient's and family's preferences play an important role in establishing a diet plan.

OTHER COMORBIDITIES

Diabetes

It is estimated that 11.6% of the American population has diabetes [16]. In these patients, elevated glucose levels can impair wound healing and negatively affect the immune system's ability to control infection. Wound healing in patients with diabetes is characterized by a decreased production and deposition of collagen and decreased strength of the healed tissue [1]. In addition, many patients with diabetes, particularly those whose disease is poorly controlled, will develop neuropathy, making the development of ulcers more likely and delaying healing.

Obesity

The number of individuals with morbid obesity continues to rise, and this in turn raises problems for wound healing [17]. Adipose tissue is poorly vascularized, placing these patients at risk for prolonged healing [1].

ESTABLISHING APPROPRIATE GOALS

At the end of the interview and physical examination of the wound(s), it should be possible to formulate goals and develop a plan of care as a team, including the patient and family [9]. Clinicians should be aware that a completely healed wound may not be an attainable goal for all patients. For example, an appropriate goal for a hospice patient might be for the wound to remain stable and for wound pain and odor to be adequately controlled.

It may also be necessary to set separate short-term and long-term goals for wound care. The short-term goals are those that would be implemented immediately in the acute care setting, while long-term goals would continue after discharge [9].

WOUND ASSESSMENT

All wounds must be thoroughly assessed. Most facilities have their own guidelines regarding minimum frequency of wound assessments, but they should occur at least once a week. Documentation of the cause of the wound is important, if this information can be obtained [13].

The wound assessment includes identifying the location of the wound; its size, shape, and depth; the condition of the wound edges; and the presence or absence of tunneling or undermining [13]. Assessment findings should also note the condition of the wound bed and how visible it is. For example, the entire surface of the wound may be visible or part or all of it may be obscured by necrotic tissue [9]. The location of the wound should be stated in a manner that is clearly understood. Anatomical markings should be used, such as the sacrum or right or left ischium [12].

EVIDENCE-BASED PRACTICE RECOMMENDATION

The National Pressure Injury Advisory Panel, the European Pressure Ulcer Advisory Panel, and the Pan Pacific Pressure Injury Alliance, recommend selecting a uniform, consistent method for measuring pressure injury size and surface area to facilitate meaningful comparisons of wound measurements across time.

(https://static1.squarespace.com/static/6479484083027f25a6246fcb/t/6553d3440e18d57a550c4e7e/1699992399539/CPG2019edition-digital-Nov2023version.pdf. Last accessed July 18, 2024.)

Level of Evidence: B2 (The recommendation is supported by level 2 studies of low quality providing direct evidence or level 3 or 4 studies providing direct evidence.)

It is important to remember that an ulcer cannot be staged until the complete wound bed can be seen [12]. If necrotic tissue is present, determine its defining characteristics, including color (black, brown, yellow, or some combination) and density (hard and leathery or soft to the touch). Necrotic tissue may be attached to the wound bed, like a second skin, or it can be loosely adhered. Even if necrosis is present, visible wound size, length, and width must still be measured and documented.

It is necessary also to evaluate any exudate in the wound and again describe it; it may be clear, bloody, serosanguineous, thick yellow, or greenish. Note whether an odor is present [9].

HISTORY OF THE WOUND

Aside from the physical condition of the wound, information about the history of the wound should be obtained. How the wound started and how long it has been present must be documented. Treatments used and the patient's wound response to these interventions should also be noted [9]. If noncompliance with treatments has been an issue, the underlying cause(s) must be ascertained. Lack of communication between the involved parties may have led to a misunderstanding on the part of the patient and/or caregiver(s) as to their role in wound care. For example, a bedbound patient in the home may require daily dressing changes by the designated family caretaker, with the home health agency monitoring wound progress on a weekly basis. To prevent inadequate care, the caretaker should be appropriately trained in the dressing technique and should understand the importance of completing the dressing changes on a daily basis. Economic strain can also contribute to noncompliance. Patients may not have the financial resources necessary to purchase dressing supplies.

WOUND PHOTOGRAPHY

With the growing awareness of the possibility of litigation in wound care, many facilities have instigated a policy of photo documentation. Wounds present on admission are photographed. In addition, some facilities require serial photographs to track wound progress and status at the time of discharge. Signed consent is required before wound photographs can be taken, and in most instances, the photographs become a permanent part of the patient's medical record. Approximately 75% of home health agencies in the United States now include wound photography as part of the patient's medical record [9]. The

American Health Information Management Association recommends that consent for photography be included in the consent for treatment when photography is routinely used. The Health Insurance Portability and Accountability Act (HIPAA) guidelines require that patients are adequately informed of the use of photography [18].

WOUND MEASUREMENT

Accurate measurement of the wound is probably the most important feature of wound assessment [9]. It provides information on the initial size and progression or non-progression of healing, allowing for valuable feedback on the effectiveness of clinical interventions. Decreasing wound size is generally regarded as a sign of wound healing [13].

Wounds should always be measured in centimeters, using a plastic or paper ruler. Wound length is measured from head to toe; width is measured from hip to hip. The depth of the wound can be obtained by gently inserting a sterile cotton-tipped applicator into the wound bed and marking it at skin level. The applicator is then measured using a metric ruler [1].

TUNNELING AND UNDERMINING

Sinus tracts and undermining impair healing, and it is important to immediately identify their presence. A sinus tract is a tunnel that extends from any part of the wound and can bore through subcutaneous tissue and muscle. This tunnel creates dead space, which can result in abscess formation and further impede the healing process. A sinus tract can be measured using a sterile cotton swab [13].

Undermining is defined as destruction of the tissue under the skin around the edges of the wound. This frequently occurs in pressure ulcers that have been subjected to shear force as well as pressure. It is important to document the location and extent of undermining.

The easiest way to measure and describe undermining is by using the face of the clock. With the patient's head representing 12 o'clock, sweep the area of undermining or probe the tunneling to ascertain the depth. For example, undermining along the right border would be recorded as extending from 1 o'clock to 5 o'clock with a depth of 4 cm [13]. It is important to check around the entire perimeter of the wound, as undermining can occur in more than one location.

WOUND BED

It is also vital to assess and document the appearance of the wound bed. If the wound bed has a mixture of tissue in it, this should be documented by an approximate percentage (e.g., the wound base is 75% granulation tissue and 25% slough). Granulation results in "beefy" red tissue with a shiny, moist granular appearance, while necrotic tissue is gray, brown, or black. Eschars are typically gray to black and dry or leathery in appearance [19]. Slough tissue is yellow/white to gray in color. It may be stringy or thick and appear as a layer over the wound bed [19]. Epithelial tissue will often begin to grow in from the edges over the wound surface. This tissue is generally pink and shiny. As a quick reference color guide, red is associated with normal healing, yellow indicates slough or dead tissue, and black is necrosis [13].

SURROUNDING SKIN

The condition of the surrounding skin surface up to 4 cm from the edge of the wound circumferentially must also be assessed and documented. Its characteristics should be noted, particularly color and integrity [14]. Maceration from excessive drainage may indicate that the dressing used is not appropriate and a different product is needed. Circumferential redness up to 2 cm from the wound is indicative of cellulitis.

WOUND PAIN

According to the NPIAP, pressure injuries cause considerable pain and suffering [3]. Pressure ulcer pain has been described as ranging from sore to excruciating. In one study, 75% of patients rated their pain as mild, discomforting, or distressing; 18% rated their pain as horrible or excruciating [20]. Another study ranked pain according to stage of pressure ulcer and found that 50% of patients with stage 2 pressure ulcers indicated their pain was discomforting. All patients with stage 3 ulcers indicated pain was distressing, and 100% of patients with stage 4 injuries rated pain as horrible [21]. Pain and odor control are a major concern for patients, and studies have shown that patients rank pain control as more important than healing [13]. The level of pressure ulcer pain depends both on the stage of the ulcer and on manipulation of the area (e.g., if a dressing change is done at the time of assessment). The majority of patients report pressure ulcer pain at rest as well as with dressing changes. Pressure ulcer pain may be due to tissue trauma, inflammation, damaged nerve endings, infection, procedures such as debridement, and dressing changes [21].

The criterion standard for assessing pain intensity is self-report using standard pain intensity instruments. Two of the most widely used pain assessment scales are the numeric pain intensity scale and the Wong-Baker Faces Pain Rating Scale [22]. The numeric pain intensity scale consists of ratings from 0 (no pain) to 10 (worst possible pain). This scale can be used for pain assessment with adults and children older than 7 years of age [6]. Visual presentation of the numeric pain intensity scale is helpful with hearing impaired patients, and the scale has been translated into many languages.

The Wong-Baker Faces Pain Rating Scale consists of six faces ranging from a happy smiling face (no pain), to a crying, frowning face (worst pain). The patient is asked to choose the face that best reflects his or her pain. The Faces Pain Rating Scale is the preferred scale for use with children and may also be used with the geriatric population. It can also be used with cognitively impaired patients and those for whom English is a second language.

After the initial pain assessment has been completed, reassessment should be done at regular intervals. As noted, pain intensity should be rated by the patient, not a healthcare professional. The following questions may be used to help determine patients' pain levels:

- What kind of pain are you experiencing?
- What word(s) would you use to best describe it (e.g., burning, aching, shooting)?
- What makes the pain better?
- What makes it worse?
- Where is the pain located?
- Does the pain radiate?
- Would you describe your pain as none, mild, moderate, severe, or excruciating?
- How would you rate your pain on a scale of 0 to 10, with 0 representing no pain and 10 being the worst imaginable pain?
- What is the pain intensity at its worst, best, and now?
- Is the pain better or worse at any particular time of the day or night?
- When does it start and when does it stop?

AN OVERVIEW OF WOUND HEALING

Wounds heal by two possible mechanisms: regeneration or scar tissue formation. The depth of the wound (i.e., the number of tissue layers involved) will determine whether the wound will heal by regeneration or by scar tissue formation [14].

Wounds can also be described as healing by primary or secondary intention. Wounds resolved by primary intention are surgically closed. With secondary intention, wounds are left open and heal via the process of granulation, contraction, and epithelialization. Pressure injuries are an example of a wound that heals by secondary intention. A third classification, wounds that heal by tertiary intention, includes cases in which healing starts by secondary intention but the wound is then surgically closed [14]. Wound

healing can be conceptualized as a cascade of events, and the process will differ depending on many different factors, particularly whether the wound is partial thickness or full thickness [14]. A partial thickness wound involves loss of the epidermis and usually part of the dermis [1]. These wounds are shallow, superficial, and painful. Healing of a partial thickness wound is usually a straight-forward process involving a brief inflammatory phase, cell migration, and re-establishment of normal skin layers [14]. The most important consideration with partial thickness wounds is to keep the area moist and clean. It is important to remember that a dry cell is a dead cell.

Full thickness wounds occur when there is destruction of the epidermis and the complete dermis. At the base of the wound, subcutaneous tissue, fascia, muscle, or bone may be visible [14]. Healing of full thickness wounds occurs in four stages: hemostasis, inflammation, proliferation, and remodeling, with considerable overlap occurring among the stages. The time frame for repair of a full thickness wound is considerably longer than that of a partial thickness wound [1]. Regardless of the cause, this biologic process of repair is the same for all acute wounds [9].

HEMOSTASIS

Hemostasis begins soon after a wound develops. This stage involves fibrin clot formation to stem blood loss and to protect the wound from bacterial infection. Studies have shown that substandard clot formation leads to poor wound healing, and individuals with impaired clotting have impaired healing [1; 14]. Clotting activates degranulation of the platelets, which causes the release of growth factors called polypeptides into the wound [9]. Growth factors begin the process of wound repair by recruiting neutrophils and macrophages to the wound bed [14].

INFLAMMATION

The standard signs and symptoms of localized inflammation are erythema, swelling, warmth, and tenderness. In normal healing, these signs are only minimally noticeable. During the inflammatory phase of wound healing, they are considered a normal response [9].

After hemostasis is established, the next stage in the process of natural healing is inflammation, which should result in the establishment of a clean wound bed. During this phase, damaged tissue is broken down and, along with excessive bacteria, removed from the wound by white blood cells [1]. The two most important cells involved in the inflammatory phase are neutrophils and macrophages [13].

Neutrophils arrive in the wound immediately after injury, usually within the first hour. For the first few days they lead the wound clean-up process [1]. They target the bacteria and debris in the wound, which is removed by the process of phagocytosis. Neutrophils have a very short life span, and around the third day after injury, they begin to disappear from the wound and are replaced by macrophages [13].

Macrophages perform multiple functions in wound repair and have been referred to as the regulators of wound repair. They are essential to the process of moving wound healing from the inflammatory phase to the proliferative phase [9]. Studies have shown that wound repair is limited or non-existent in the absence of macrophages [14].

When caring for a wound in the inflammatory phase, the goals are debridement and infection control. These wounds usually have a great deal of drainage, so absorptive dressings are normally used [14]. The end result of the inflammatory phase is a clean wound bed [1].

PROLIFERATION

The proliferative phase of wound healing overlaps and follows the inflammatory phase. During this process, the wound bed is filled with new granulation tissue and the wound is resurfaced with new epithelial tissue [14]. This stage can last for several weeks [9].

In full thickness wounds, the process of re-epithelialization occurs only from the wound edges [14]. Margin basal cells attached to the dermis eventually loosen and start migrating across the wound. The horizontal movement comes to a halt when the cells meet [9]. This is called contact inhibition. Wound contraction is the final part of the proliferative phase. Fibers in the wound contract to bring the wound edges closer together.

MATURATION/REMODELING

Maturation and remodeling of the wound involves rearranging collagen fibers and increasing the tensile strength of the scar tissue. Scar tissue regains about 80% of normal tissue strength within three months, but it is important to note that it never achieves the full strength of the original tissue [14]. Therefore, the healed site of an old wound is vulnerable to further breakdown.

WOUND CLEANING

The Institute for Clinical Systems Improvement (ICSI) recommends that all pressure ulcers be cleaned when first diagnosed and then with every dressing change [23; 24]. The purpose of wound cleaning is to remove nonadherent debris from the wound bed in order to promote healing and make the wound less susceptible to bacterial overgrowth and infection [13]. While cleaning the wound, it is necessary to minimize trauma to the wound bed and healthy tissue [13]. Choosing the correct product for cleaning the wound is very important. Most wounds can be effectively cleaned with normal saline, a nontoxic and inexpensive product [9; 24]. If used, saline must be applied to the wound with sufficient force to remove surface debris and contaminants while also minimizing trauma to the wound [1]. Normal saline used for wound cleansing should be room temperature and should be discarded within 24 to 48 hours after opening [9].

The most frequently used method for wound cleansing is irrigation [1]. Studies of the optimal irrigation pressure for effective wound cleaning have found that pressures less than 4 pounds per square inch do not remove wound debris and pressures greater than 15 pounds per square inch force the debris into the wound tissue rather than removing it [1]. The goal is to obtain pressures in the range of 8 to 15 pounds [14]. Irrigation should be done gently using a 35-cc syringe and a 19-gauge needle [14]. An angiocatheter can be used instead of a needle to decrease the risks of finger sticks [1].

If a large amount of debris is present in the wound, use of a commercial cleaning agent may be necessary. Wound cleansers with surfactants in their composition are helpful when the wound is heavily burdened with surface debris. These cleansers break the chemical bonds that attach the wound debris and cause it to loosen from the wound bed [13].

Antimicrobial agents have usually been discouraged for wound cleansing, and they are not required for cleaning healthy, noninfected wounds [9; 25]. However, research has shown that antiseptic agents such as sodium hypochlorite and povidone iodine (both at the strength of 0.25%) are safe to use in wound care for short periods of time (four to seven days) to decrease the bacterial burden [9; 25]. Sodium hypochlorite should be used for no longer than 10 days due to cytotoxicity of healthy cells and granulating tissues surround the wound [25; 26; 27]. Some studies show that infection rates using povidone iodine are similar to those when saline was used; saline may be as effective as and safer to use than povidone iodine [26; 27]. The benefits of these products should be weighed against the possible risk of bacterial resistance. Skin cleansers (e.g., those used to remove feces from the skin) are much more toxic than wound cleansers and should not be used for wound care [13].

PAIN MANAGEMENT

The goals of pain management in the pressure ulcer patient are to provide analgesic relief and to eliminate the cause of pain. There are several interventions and practice modifications that can prevent or manage wound-associated pain.

Skin care and assessments should be performed at a time of day when the patient is least fatigued [12]. All procedures should be thoroughly explained before they are performed. If a patient has questions, this should be addressed, and healthcare professionals should be encouraging and provide positive reinforcement. It is important to avoid trauma (e.g., shearing, tear injuries) to fragile skin during transferring, positioning, or holding a patient. If

necessary, adjunctive medications may be administered to improve sleep and reduce anxiety, which can contribute to experiences of pain.

Dressing changes are often very painful. An analgesic may be administered 30 minutes before dressing changes, and if possible, the number of daily dressing changes should be kept to a minimum. Tape should always be avoided on fragile skin. If patients are able, they should be allowed to remove their own dressings or set the pace of dressing changes. All patients should be assessed for pain before, during, and after dressing changes, and these findings must be documented [13].

Physical therapy and occupational therapy may be helpful to decrease contractures and muscle spasm. Of course, ensuring proper seating and positioning can improve pain scores and decrease the risk for further pressure injuries.

WOUND DEBRIDEMENT

Necrotic tissue compromises wound healing and can be a source of bacterial overgrowth [9]. It stalls wound healing in the inflammatory phase and prevents the natural progression of healing [14]. For a wound to heal, it must be free of nonviable tissue, and this is commonly achieved by debridement [13].

Necrotic tissue adheres to the wound bed more when the moisture level in the wound drops and the amount of tissue damage increases [9]. It can present in different forms, though most necrotic tissue is firm and dry. Beneath the dry necrotic tissue is slough, the moist, soft, dead tissue often found loosely attached to the wound bed. Slough has a stringy appearance and may be brown, yellow, or gray in color [1].

In addition to helping move the wound through the stages of healing, debridement is often necessary to visualize the wound bed and stage the wound; a wound covered with necrotic tissue cannot be staged [13]. An exception is eschar on the heels, which acts as a natural biologic cover, and should not be removed unless infection is present.

The method of debridement used depends on the amount of necrotic tissue present, the location of the wound, and the patient's overall condition [9]. By definition, stage 1 pressure injury does not require debridement. The wound should simply be covered with transparent film for protection and preventive measures taken to limit progression and reduce the risk for additional pressure injury elsewhere. Stage 2 and early stage 3 wounds can often be debrided effectively with autolytic and/or enzymatic debridement technique, as discussed in detail later in this section. Patients with stage 3 or 4 pressure ulcers who have undermining and/or tunneling or extensive necrotic tissue should have a surgical evaluation for possible surgical debridement of the wound, if this is consistent with their condition and the goals of care [2; 6]. Infected wounds may require systemic antibiotic treatment and immediate surgical debridement [13]. Maintenance debridement should be continued until there is a covering of granulation tissue in the wound bed and the wound is free of necrotic tissue [6].

According to the National Pressure Injury Advisory Panel, the European Pressure Ulcer Advisory Panel, and the Pan Pacific Pressure Injury Alliance, pressure injuries should be debrided of devitalized tissue and suspected or confirmed biofilm, with maintenance debridement performed until the wound bed is free of devitalized tissue and covered with granulation tissue.

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Level of Evidence: B2 (The recommendation is supported by level 2 studies of low quality providing direct evidence or level 3 or 4 studies providing direct evidence.)

AUTOLYTIC DEBRIDEMENT

The body's own physiologic processes to remove necrotic tissue are referred to as autolytic debridement [9]. Studies have shown that autolytic wound debridement is more effective than wet-to-dry dressings because it removes only necrotic tissue and leaves healthy tissue intact [9]. For autolytic debridement to be successful there must be a moist environment and sufficient white blood cells available to the wound [1]. A layer of wound exudate should be kept in contact with the surface of the wound [14]. A moisture-retaining dressing may be used to keep the wound bed moist [9; 13]. This allows fluid to accumulate in the wound, rehydrating necrotic tissue and making it possible for enzymes in the wound to digest the dead tissue [9]. For a wound covered with dry eschar, it is appropriate to crosshatch the eschar, as this allows a faster build-up of moisture in the wound [9]. In their clinical practice guidelines for pressure ulcer treatment, the ICSI recommends autolytic and enzymatic debridement as the preferred approach for patients in long-term care and home care and for patients who cannot tolerate other methods of debridement [9; 23].

Choosing the correct product and dressing material for autolytic debridement is important to successful healing; a semi-occlusive or occlusive dressing should be used [13]. In addition, amorphous hydrogels are effective in digesting necrotic tissue in wounds and may be used as an adjunct [9].

Transparent film dressings are the best choices for debriding dry eschar, as they are non-absorptive. These dressings establish a fluid environment. For moist wounds with necrotic tissue, hydrocolloids are a good choice. Hydrocolloids have the ability to absorb a certain amount of drainage while maintaining a moist wound environment [9].

There are several advantages to autolytic debridement. It is relatively inexpensive and harmless to healthy tissue. Wound progress is usually seen within six days, and it can be used in combination with other debridement methods for enhanced effect [9]. It is generally a good option for patients whose condition does not permit surgical intervention.

The disadvantage of the autolytic approach is that lack of familiarity with the process can cause problems. The breakdown of dead tissue and the subsequent odor and accumulation of exudate may cause clinicians/family members to wrongly infer that the wound is either infected or worsening [1].

Nursing staff and caregivers should understand that the accumulated fluid in the wound contains essential factors necessary for debriding the wound and promoting wound repair [1]. Education should also note that the wound will initially become larger with debridement, but this is not a sign that the wound is deteriorating [13].

ENZYMATIC DEBRIDEMENT

Enzymatic debridement is a safe and effective method that involves the application of a concentrated, commercially prepared enzyme to the surface of the necrotic tissue [13]. It is recommended when surgical debridement is not an option and the patient is not considered a good candidate for autolytic debridement [9; 23].

Enzymatic debridement is a selective method that will not adversely affect healthy tissue [9]. Applied enzymes liquefy the necrotic tissue and destroy the bonds that attach it to the wound bed [12]. The advantages of enzymatic debridement are that it does not harm healthy tissue in the wound and can be effectively used in combination with other methods of debridement [9]. Eschar present in the wound should be crosshatched before application of enzymatic therapy to improve efficacy, as enzymes are not active on a dry surface [9].

Wound progress should be seen in 48 to 72 hours. However, complete debridement of the wound may be a long process; therefore, whenever possible this method is used in conjunction with autolytic debridement and conservative surgical wound debridement (i.e., bedside removal of loosely adherent necrotic tissue) [14]. Conservative surgical wound debridement is completed by a physician or a wound care nurse.

Enzyme formulations available for debridement include collagenase (Santyl), papain (enzymes derived from papaya), and trypsin (Granulex, Vasolex, Xemaderm); only collagenase is available in the United States [12]. Collagenase is a derivative of *Clostridium* bacteria and acts by liquefying the collagen bonds that fasten necrotic tissue to the underlying wound bed. The time to effect ranges from several days to weeks.

Enzymatic debridement can be used in conjunction with most other dressings; however, it should not be used with silver or cadexomer iodine dressings. Silver dressings reduce the efficacy of collagenase by more than 50%; cadexomer iodine reduces its efficacy by 90% [28].

Studies indicate that enzymatic debridement is cost-effective, but it requires daily or twice daily dressing changes and the application of a secondary cover dressing, which should be factored into the cost [28]. When the wound bed is free from necrotic tissue and slough, the use of enzymatic debridement should be discontinued.

Enzymatic debridement is not generally indicated for the treatment of infected wounds due to the extended length of time required to achieve a clean wound. If necessary, enzymes may be used in cases of infected wounds if antibiotic therapy has already been initiated [14].

MECHANICAL DEBRIDEMENT

Mechanical debridement is achieved by applying outside force to remove necrotic tissue in a wound [9; 23]. One long-standing and widely used form of mechanical debridement is wet-to-dry gauze dressings, usually with normal saline. Although it is a commonly used treatment, the advantages of familiarity and simplicity of use are outweighed by the disadvantages. Studies indicate that wet-to-dry dressings remove healthy viable tissue as well as necrotic tissue [9]. In addition, the standard time frame for dressing changes, every eight hours, increases the associated costs of labor and supplies. The dry, adherent dressings are painful to remove, and seepage of moisture from the dressing can lead to maceration of periwound tissue. As such, the AHRQ advises cautious use of this method of debridement [9].

Whirlpool therapy is another form of mechanical debridement. It is most frequently used with larger wounds to remove debris and bacteria from the wound bed. However, it does not remove dry eschar from the wound, and there are concerns about the likelihood of cross-contamination between patients [1].

The use of ultrasound waves to debride wounds has also been explored. With this technique, low-frequency ultrasound creates small bubbles in the wound that implode, causing the necrotic tissue to liquefy [12]. This method is generally less painful and less traumatic than traditional methods, with faster healing rates compared to other methods of mechanical debridement [29; 30]. Studies show that low-frequency ultrasound is most effective when used three times per week [30]. However, further comparative evidence and large-scale studies are necessary before it can be recommended as a replacement for established treatment modalities [30; 31].

Maggot Debridement Therapy

Maggot debridement therapy (MDT), an approach popular at the early 20th century, is finding a renewed place in wound care debridement [13; 32]. Much of this interest is centered on the ability of maggots to ingest and destroy micro-organisms without inducing resistance among bacterial organisms. It is believed that the larvae secrete enzymes, including collagenase, that break down the necrotic tissue; they also ingest and destroy micro-organisms [1]. Maggots have the ability to access moist tissue throughout the wound bed and clean small areas without harming healthy tissue [33]. The process involves the application of sterilized larvae from the green-bottle fly maggots to the wound bed every two to three days. The maggots can be applied to the wound directly or in a containment pouch [13]. The most appropriate dressing for wounds treated with maggots is one that keeps the larvae in place, allows for a flow of oxygen, and is suitable for the characteristics of the wound [9].

MDT is indicated for pressure ulcers with necrotic tissue with or without infection [33]. It has also been shown to be an effective treatment of diabetic wounds [34]. Maggots work well in wounds in which moisture and oxygen are readily available and the pH is fairly stable [9]. The therapy is considered mainly for the treatment of wounds for which other forms of treatment are either not appropriate or not successful [14]. MDT is contraindicated in patients who have bleeding abnormalities or deep tunneled wounds [13]. Because there is no benefit in continuing MDT past one week, another type of dressing should be used after two or three applications of MDT [35].

Precautions should be taken to prevent the larvae from coming in contact with healthy skin, as there is a possibility of enzymatic damage. Otherwise, there are no reported side effects from maggot therapy. However, some patients complain of a crawling or tingling feeling [1]. Maggot therapy may also cause psychologic distress for many patients, and its use should be discussed thoroughly with the patient and/or family prior to commencing therapy [13]. This therapy should only be used with appropriately informed consent.

CHEMICAL DEBRIDEMENT

Chemical debridement utilizes nonenzymatic solutions to break down necrotic tissue in wounds [14]. The most widely used are sodium hypochlorite (bleach) solutions, including Dakin's solution, and oxychlorosene (Clorpactin WCS-90) [14; 36; 37]. Dakin's solution at the strength of 0.25% is nontoxic to healthy tissue, and gauze dressings soaked in Dakin's solution help to dissolve necrotic tissue and decrease the bacterial burden in the wound [14]. Regardless of the chemical used, the dressings must be changed every 12 hours. The periwound area should be protected from contact with the dressing, either with petrolatum ointment or strips of solid skin barrier around the edges of the wound [14].

Dakin's solution is normally stored in clear containers. It loses its potency in 24 to 48 hours and must be replaced at least every other day. When first opened, containers should be labeled with the date and time. After the wound is free from necrotic tissue, the use of sodium hypochlorite or oxychlorosene should be discontinued [14].

WOUND DRESSINGS

Wound dressings are a pivotal aspect of wound care [6]. Dressings insulate the wound from the external environment, provide a barrier to prevent bacterial infection, maintain a moist environment, wick fluid from areas of tunneling, and absorb drainage [14]. Ideally, a wound dressing should also provide for gaseous exchange, allowing oxygen, carbon dioxide, and water vapor to pass in and out through the dressing [9].

When choosing a wound dressing, one of the most important factors to consider is the type of tissue in the wound bed—granulating or slick looking, moist or dry. Also consider the depth of the wound, whether tunneling or tracking is present, and the amount of drainage [14]. The condition of the skin surrounding the ulcer must also be determined [6].

Wound dressings can be divided into two main categories: those placed inside the wound in contact with the wound bed and those placed on top of the wound as a cover. Shallow wounds with little drainage may only require a cover dressing. However, wounds with a depth greater than 0.5 cm and/or with tunneling or undermining often require both an internal and a cover dressing [14]. As the wound changes, the type of dressing may also need to be changed [6].

Dressings can also be categorized according to their ability to introduce or wick moisture. Dressings that add moisture to the wound bed are referred to as hydrating; dressings that remove excess exudates from the wound surface are absorptive [14].

HYDROCOLLOIDS

Hydrocolloids are excellent dressings for the prevention of secondary infections [14]. In the past, hydrocolloids were considered occlusive dressings, but more recent versions have a backing of a semiocclusive film layer that is impermeable to fluids and bacteria but semipermeable to gas and water vapor [1]. Hydrocolloids can accommodate only moderate amounts of wound drainage and are therefore not used for heavily draining wounds [14].

These dressings can produce an odor upon removal. In the absence of other signs of clinical infection, this is not an abnormal finding and should be explained to concerned patients and staff [13]. Hydrocolloids may also leave a residual in the wound bed, which should be gently irrigated out at dressing change. Hydrocolloids lose their effectiveness if they are changed too frequently and should not be used for wounds that need to be monitored daily [1].

EVIDENCE-BASED PRACTICE RECOMMENDATION

The National Pressure Injury Advisory Panel, the European Pressure Ulcer Advisory Panel, and the Pan Pacific Pressure Injury Alliance recommend using hydrocolloid dressings for non-infected category/stage 2 pressure injuries, as indicated by the clinical condition of the pressure injury.

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Level of Evidence: B1 (The recommendation is supported by level 1 studies of moderate or low quality providing direct evidence or level 2 studies of high or moderate quality providing direct evidence.)

HYDROGEL

Hydrogel dressings are used with shallow wounds with minimal amounts of drainage and are also a good option for painful ulcers [6]. Hydrogel dressings are usually hydrating and are either glycerin- or water-based [1]. These dressings are appropriate for use with topical medications and antibacterial agents [13].

Amorphous hydrogel dressings are especially useful for wounds with depth and contours [6]. However, these dressings provide only minimal absorption and should be used in wounds with small amounts of exudate [14]. Amorphous hydrogel dressings vary widely in their level of viscosity and are available in sheet dressing, tube, spray bottle, and ribbon gauze [1].

FOAM DRESSINGS

Foam dressings are a good choice for stage 2 and shallow stage 3 injuries with drainage and for painful pressure injuries. Foam dressings protect wounds at risk of further damage from shear and can be used along with topical treatments [6; 13]. Foam dressings impregnated with ionic silver are available to reduce the risk of infection. These dressings can also be used along with alginates to improve management of wound drainage [1]. Foam provides for thermal

insulation, conforms to body shape, and leaves no residual in the wound [9]. Clinicians must be careful to place the correct side of the foam dressing in contact with the wound surface [13].

SILVER-IMPREGNATED DRESSINGS

Silver-impregnated dressings are a treatment option for infected or heavily colonized wounds or wounds that are at increased risk for infection. Silver has an antimicrobial effect on a broad spectrum of organisms and has been shown to reduce the bacterial count in wounds, except for highly exuding wounds where the cytotoxic properties of silver may offset these advantages [1; 38]. Sustained-release silver dressings are toxic to bacteria and fungi but do not adversely affect healthy wound tissue [14]. However, silver-resistant organisms do exist, and the judicious use of silver is advised, similar to the approach adopted with antibiotics [1; 38]. It is recommended that the use of silver dressings be limited to a two- to four-week period [1].

CADEXOMER IODINE DRESSINGS

Cadexomer iodine dressings are used for wounds with moderate-to-high amounts of drainage. They should not be used for patients who are sensitive to iodine or individuals with thyroid disease [39]. Cadexomer iodine dressings are antimicrobial and help fight bacteria while maintaining a moist environment for wound healing [13]. Although these dressings are capable of reducing bacterial counts in wounds, they do not replace the need for systemic antibiotic therapy and are regarded as an adjunct in the treatment of wound infections [13]. One systematic review found no clear difference between cadexomer iodine and standard care [40].

CALCIUM ALGINATE DRESSINGS

Calcium alginate dressings are highly absorptive dressings made from lightweight seaweed. They can absorb up to 20 times their weight in wound drainage, which makes them an excellent choice for heavily draining wounds [13]. There are two types of alginates: one that becomes a gel after coming in contact with the wound drainage and one that retains its original shape while absorbing exudates [14]. In addition to their absorptive abilities, calcium alginate dressings can aid in hemostasis, making them a good choice for bleeding wounds. They also have been found to be effective against both Gram-positive and Gram-negative bacteria [41]. Wounds treated with alginate dressings made from seaweed may smell fishy or like "low tide" [13].

HYDROCOLLOID FIBER DRESSINGS

Hydrocolloid fiber dressings are used only in wounds with large amounts of drainage. They are placed in the wound dry and transform into a gel after absorbing exudate [14]. These dressings are comfortable and easy to remove, but they usually require a secondary dressing to hold them in place [13].

GAUZE

Gauze packing was used frequently in the past, but it is now regarded as less effective in coping with wound drainage than calcium alginate or hydrocolloid fiber dressings. Gauze dressings do not provide a barrier against bacteria, do not lower wound temperature, and can pull healthy granulating tissue out of the wound on removal [14]. Gauze dressings are also labor intensive, requiring several dressing changes daily, which adds to the cost of the overall care [13].

COMPOSITE DRESSINGS

Composite dressings are a combination of more than one material used to fulfill several important functions in the wound. They provide an effective barrier to bacterial contamination of the wound and include an absorptive layer and foam, hydrocolloid, or hydrogel. Composite dressings can have either a semi-adherent or non-adherent surface placed in contact with the wound bed [13]. Composite dressings are comfortable and are available in various shapes and sizes [1]. These dressings should not be cut, as this compromises the structure of the dressing [13].

COLLAGEN DRESSINGS

Some dressings incorporate collagen, which is an important protein involved in wound healing and repair [1]. The dressings can be 100% collagen or combined with other products, such as alginates. They provide a high level of absorption while keeping the wound bed moist and are easily removed [13]. For wounds with very little drainage, collagen gel can be applied in a layer one-quarter inch thick [1]. Collagen used in most wound dressings is derived from cowhide. Therefore, it should not be used in patients who are allergic to bovine products [13].

SPECIAL CONSIDERATIONS

Tunneling and Undermining

An occlusive dressing should not be placed over wounds with tunneling and undermining due to the danger of anaerobic micro-organism growth [13]. Ribbon gauze should be used to fill areas of narrow tunneling, with the end of the gauze placed securely in the wound base to allow for easy retrieval [12].

Wound Packing and Filling

Wounds are packed to fill dead space and eliminate the possibility of abscess formation caused by premature closure of the wound. The materials used for packing should conform to the base and sides of the wound. Wound packing material should be fluffed and placed loosely into the wound using a cotton swab [1]. It is important to ensure that the dressing material is in contact with all wound surfaces but also that the wound is not overpacked.

Wound fillers come in hydrated form, usually paste or gels, or dry form, which includes powder, granules, beads, and rope. Wound fillers can contain collagen, alginate, foam, or hydrogel. They are nonadherent and require a secondary dressing to hold them in place. Dressing changes of packed wounds are normally done on at least a daily basis [1].

Frequency of Dressing Changes

The frequency with which a dressing will be changed depends on several factors, including the manufacturer's guidelines, the condition of the wound, and the amount of drainage present. Daily or every other day dressing changes are usually better for the patient, being less painful and more cost effective than dressings that must be changed two to three times per day [14]. This should be taken into consideration when selecting wound dressings.

WOUND MONITORING

Routine evaluation of wound treatments and wound progression is essential, and wounds should be assessed at each dressing change [1]. Clinical signs of improvement are expected to appear within two to four weeks [14]. When evaluating the wound, the most important factor to consider is whether the wound is progressing toward the goals established at the onset of treatment. If the wound is not progressing, further assessment and adjustment of the treatment approach are warranted [1].

For nonhealing wounds, the first factor to evaluate is the quality of wound care. This includes determining if dressing changes are being carried out at the recommended intervals, if the dressings are applied appropriately, and if the manufacturer's instructions for product use are being followed [1]. Factors affecting the patient's condition should be taken into consideration and addressed appropriately. Failure of a wound to improve is often due to systemic factors, such as ischemia, infection, or malnutrition, or continuation of the causative factors. These issues must be addressed first to achieve optimum wound healing. A change in the dressing treatment is indicated if any of the following problems occur [14]:

- Maceration of the surrounding skin
- Inadequate control of wound drainage
- A change in the amount of drainage or the depth of the wound

Reverse staging of pressure injuries is not an acceptable approach to gauging the level of wound healing. Healed pressure injuries do not replace lost muscle, subcutaneous fat, or dermis [6]. Tools that do appropriately measure degrees of healing include the Bates-Jensen Wound Assessment Tool and the Pressure Ulcer Scale for Healing (PUSH) Tool [13; 42]. The Bates-Jensen Wound Assessment Tool has thirteen variables that provide a composite picture of the status of the wound [13]. The PUSH tool uses scores in three domains (i.e., size, exudate amount, and tissue type) to indicate improvement or deterioration of the ulcer. A score of 0 on the PUSH tool indicates the wound has healed, whereas the highest score of 17 indicates wound degeneration [13].

DOCUMENTATION

Wound care documentation should be concise and frequent [13]. It should be based on nationally recognized standards of care; shortcuts should not be used, and only approved abbreviations should be included in the documentation [12]. Problems arise when there are numerous and different descriptions of a pressure injury [1]. If present, all wounds should be documented on admission to provide a baseline comparison for future assessments [13]. Subsequent wound care provided must be recorded, including accurate dates and times and the name of the clinician providing the care. All statements should be substantiated by objective clinical findings. The condition of the wound on discharge should be thoroughly documented and reported to the agency providing follow-up care. As noted, photography is becoming increasingly commonplace.

PREVENTION OF PRESSURE INJURIES

All persons who are bedfast or chairfast should be considered at risk of developing pressure injuries. Specific potential risk factors include conditions that limit mobility, such as stroke, debilitating illness, frail elderly, and injuries that require external medical devices (e.g., fracture casting).

The 2019 NPIAP/EPUAP guideline and the 2016 prevention points advocate attention to the following principles of preventive skin care for at-risk persons and for patients with an established pressure injury [6; 43]:

- Skin should be examined within eight hours of admission, and a structured risk assessment (e.g., the Braden Scale) should be conducted as close to eight hours after admission to identify individuals at risk of pressure injury.
- Avoid positioning the individual on an area of skin redness whenever possible.
- Keep the skin clean and dry.
- Do not massage or vigorously rub skin zones at risk (i.e., over bony prominences).
- Develop and implement an individualized continence management plan.
- Protect at-risk zones of skin from excessive moisture with a barrier product.
- Consider prophylactic dressings, such as polyurethane foam dressing, to protect skin over boney prominences (e.g. back, sacrum) or in direct contact with medical devices.

Patients with any degree of pressure-induced skin injury/ulcer should be positioned and repositioned at frequent, regular intervals throughout the day, making use of foam mattresses or protective overlays designed to reduce pressure and avoid friction/shear.

PROGNOSIS

With appropriate care (i.e., careful and through assessment), treatment of comorbidities, diligent wound management, and maintenance of nutrition, the prognosis for complete healing of pressure injuries is very good, especially if intervention occurs before late stage 3 progression. A two-year observational study of 1,626 patients with stage 2 through 4 pressure ulcers admitted to 51 nursing homes in all parts of the country found that with standard care, 74% of stage 2, 60% of stage 3, and 33% of stage 4 injuries had healed completely at six months [44]. Of surviving patients at one year of therapy, 87%, 80%, and 60% respectively had healed.

CONCLUSION

Wound care is an exciting and ever-evolving practice, and a coordinated team effort can bring about remarkable results. Healthcare professionals must keep abreast of the growing scientific research in this area, as newer or re-discovered treatments can impact nursing practice and expected patient outcomes. An improved knowledge and appreciation of wound development and healing will enhance patient care and ultimately quality of life.

RESOURCES

National Pressure Injury Advisory Panel (NPUAP)
Educational and Clinical Resources
https://npiap.com/page/resources

European Pressure Ulcer Advisory Panel (EPUAP)
Pressure Ulcer Guidelines
https://epuap.org/pu-guideline

Agency for Healthcare Research and Quality (AHRQ)
Preventing Pressure Ulcers in Hospitals
https://www.ahrq.gov/patient-safety/settings/hospital/resource/pressureulcer/tool/index.html

Implicit Bias in Health Care

The role of implicit biases on healthcare outcomes has become a concern, as there is some evidence that implicit biases contribute to health disparities, professionals' attitudes toward and interactions with patients, quality of care, diagnoses, and treatment decisions. This may produce differences in help-seeking, diagnoses, and ultimately treatments and interventions. Implicit biases may also unwittingly produce professional behaviors, attitudes, and interactions that reduce patients' trust and comfort with their provider, leading to earlier termination of visits and/or reduced adherence and follow-up. Disadvantaged groups are marginalized in the healthcare system and vulnerable on multiple levels; health professionals' implicit biases can further exacerbate these existing disadvantages.

Interventions or strategies designed to reduce implicit bias may be categorized as change-based or control-based. Change-based interventions focus on reducing or changing cognitive associations underlying implicit biases. These interventions might include challenging stereotypes. Conversely, control-based interventions involve reducing the effects of the implicit bias on the individual's behaviors. These strategies include increasing awareness of biased thoughts and responses. The two types of interventions are not mutually exclusive and may be used synergistically.

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