
ULCER AND WOUND CARE: GETTING TO THE DEPTH OF THE TISSUE

Course # 720
5 Contact Hours

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Ulcer and Wound Care: Getting to the Depth of the Tissue

Disclosures

Description

Author(s): Lydia Corum, RN, MSN, CWCN

The purpose and goal of this course is to educate healthcare professionals about how to recognize the phases of healing and types of ulcers and infection. You will be able to recognize infection, document, intervene with new treatments and choose the type of dressing that will promote healing.

Learning Outcomes include:

- Describe the 4 phases of the healing cycle and the important characteristics of each phase.
- Differentiate between colonized or contaminate, critically colonized, and infected ulcers.
- Explain how to accurately measure the length, width, and depth of an ulcer.

Criteria for Successful Completion

After reading the material, complete the online evaluation. If you have a Florida nursing license or an electrolyology license you must also complete the multiple choice test online with a score of 70% or better. Upon completion of the requirements you may immediately print your CE certificate of completion.

Accreditation

- National Center of Continuing Education, Inc. is accredited as a provider of nursing continuing professional development by the American Nurses Credentialing Center's Commission on Accreditation
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- This course has been approved by the Florida Board of Nursing No. 50-1408
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Conflicts of Interest

No conflict of interest exists for any individual in a position to control the content of the educational activity.

Expiration Date

This course expires July 31, 2022.

About the Authors

Lydia Corum, RN, MSN, CWCN is a Certified Wound Care Nurse. She has been

working with wounds for more than 17 years. Lydia has an extensive knowledge of wound care and diagnoses that affect wound healing, and a passion to heal patients. Her guiding philosophy is, "It is not the importance of healing the wound, but healing the patient". Lydia developed her outlook from classes, hands on experience, research and doctors' influence. She has worked in a variety of health care settings including home healthcare, extended care facilities, wound clinics, hospitals and a healing institute. Lydia gained particular expertise in dressings, their costs and budgets while working as a supply manager for a home healthcare agency. She is currently a passionate advocate and educator to improve wound care costs and ensure that patients receive better healing and care.

Shelda L. Hudson, RN, BSN, PHN, Director of Healthcare Information, completed her baccalaureate degree in Nursing and public health certificate at Azusa Pacific University. Ms. Hudson has over 21 years of extensive experience in publishing courses in continuing education for healthcare professionals with the National Center.

Purpose and Goals

The purpose of this course is to gain an understanding of the current treatments for a variety of ulcers. The goal is for the nurse and other health care professionals to be able to recognize the phases of healing and the types of ulcers. The professional will be able to recognize infection and be able to document and intervene with new treatments. Using an accurate assessment of the ulcer, the professional will be able to choose the type of dressing that will promote healing.

Learning Outcomes

At the end of this course you should be able to:

1. Describe the four phases of the healing cycle and the important characteristics of each phase.
2. Differentiate between colonized or contaminate, critically colonized, and infected ulcers.
3. Outline the characteristics of infected ulcers.
4. Differentiate between the types of ulcers and risk factors involved in prevention.
5. Outline a complete assessment of the patient with skin assessment emphasized.
6. Explain how to accurately measure the length, width, and depth of an ulcer.
7. Choose the type of dressing that will promote moist ulcer healing.

(Note: A glossary of terms is listed at the end of the course to enhance your learning

experience).

Introduction

The process of trying to understand ulcer healing traces back to ancient times and has continued to be investigated. Interest grew in the 1900s, and, by 1960, it was understood that ulcer healing time could be decreased up to 50% if appropriate settings are created. Continuing from that time, there has been an ongoing expansion to understand not only the vast array of intrinsic and extrinsic factors of ulcer healing, but also the intracellular, extracellular, molecular, and biochemical processes and interactions that facilitate healing.

In January 2018, Value in Health, the journal of The International Society of Pharmacoeconomics and Outcomes Research it was reported that in 2014 14.5% of Medicare beneficiaries, 8.2 million people, were diagnosed with at least one type of wound or wound-related infection. Total spending for wound care was estimated to be from \$28.1 billion to \$96.8 billion. Of all types of wounds, the largest categories and most spending were for treatment of surgical ulcers and then diabetic foot ulcers. Outpatient treatment costs exceeded that of hospital inpatient care. Increasing costs of health care, an aging population, recognition of difficult-to-treat infection threats such as biofilms, and the continued threat of diabetes and obesity worldwide make chronic wounds a substantial clinical, social, and economic challenge. With a desire to create a better mousetrap, the government is looking how to change the health care system. With this information it is important to educate ourselves as well as professionals in the best ways to heal ulcers at the lowest price.

An opened area in the skin can be defined as an ulcer, wound or injury, depending on its etiology. The National Pressure Ulcer Advisory Panel (NPUAP) announced changing its preferred terminology from pressure ulcer to pressure injury, to reflect injuries with intact skin and ulcerated skin, in 2016. Since the International Statistical Classification of Diseases and Related Health Problems revision 10 (ICD-10) came into use a wound is called an ulcer if its etiology is not an instrument (scalpel, knife, gun, etc.). With the terminology changes, the importance of advanced ulcer care is still the assessment of the physical, financial and social issues that encompass the ulcer dynamic. Each ulcer and patient is different in need and how each heal. As with all health care today, evidence-based care needs to include a plan that has the patient in mind. The ulcer does not heal itself; the person heals the ulcer. As portrayed by Jean Watson: "Society needs the caring professions, and nursing in particular, to help to restore humanity and nourish the

human heart and soul in an age of technology, loneliness, rapid change, and stresses, an age without moral or ethical wisdom, as to how to serve humanity.”

Ulcer healing is a continuation, communication and collaboration of care. The 3 Cs need to start from the time the patient is admitted with the wound and continues until the ulcer is healed. All disciplines are communicating, interacting with the patient as well as caregivers to assure the plan of care is understood and accepted. Jean Watson states: “Unknowns can also lead to illness; the unknown can only be known by experience and may require inner searching to find meaning.” The healing comes from the person and knowledge of disease process, healing becomes difficult when the person is left unknowing or unsure of how the ulcer is progressing or what the plan of care is. Though many patients do want healing to occur, there are those patients that feel continued illness allows him/her to get the attention needed. It is very important to assess the ulcer and the person each time the person is seen. This assures the patient of quality care for which the patient has control.

Please note that in this course and professionally, the terms “ulcer” and “wound” generally are used interchangeably without regard to etiology.

Basic Types of Ulcers

Abrasions – Abrasions are made when the skin is rubbed or scraped off. Rope burns, rug burns, and skinned knees or elbows are common examples of abrasions. This kind of wound can become infected quite easily because dirt and germs are usually embedded in the tissues. These are classified as full and partial thickness.

Arterial - Arterial ulcers are the result of lack of blood flow to lower extremities. These ulcers are dry and necrotic. Many have black eschar present. There is not much that can be done with these wounds without increasing the blood flow to the area. These are normal full thickness wounds, painful and dry.

Diabetic - Diabetic ulcers are located below ankle and are related to neuropath or deformed feet from arterial and venous blood flow. These wounds are classified as full or partial thickness.

Incisions – Incisions, commonly called cuts, are wounds made by sharp cutting instruments such as knives, razors, scalpels and broken glass. Incisions tend to bleed freely because the blood vessels are cut cleanly and without ragged edges. There is little damage to the surrounding tissues. Of all classes of wounds, incisions are the least likely to become infected, since the free flow of blood washes out many of

the microorganisms that cause infection. These are classified as full and partial thickness.

Lacerations – These wounds are torn, rather than cut. They have ragged, irregular edges and masses of torn tissue underneath. These wounds are usually made by blunt rather than sharp objects. A wound made by a dull knife, for instance, is more likely to be a laceration than an incision. Bomb fragments often cause lacerations. Many of the wounds caused by accidents with machinery are lacerations; these are often complicated by crushing of the tissues as well. Lacerations are frequently contaminated with dirt, grease, or other material that is ground into the tissue; they are therefore likely to become infected. These are classified as full and partial thickness

Pressure - Pressure Injuries are created when there is loss of blood flow over a bony area of skin. This does not include the buttock unless the patient is in surgery, in a supine position for greater than three hours. These wounds are staged from 1 to 4 with Unstageable and Deep Tissue injury being how classified.

Punctures – Punctures are caused by objects that penetrate into the tissues while leaving a small surface opening. Wounds made by nails, needles, wire, and bullets are usually punctures. As a rule, small puncture wounds do not bleed freely; however, large puncture wounds may cause severe internal bleeding. The possibility of infection is great in all puncture wounds, especially if the penetrating object has tetanus bacteria on it. To prevent anaerobic infections, primary closures are not made in the case of puncture wounds. These are classified as full and partial thickness

Venous Insufficiency - Venous insufficiency wounds are related to the lack of blood flow returning to the heart from lower extremities. These wounds are a result of incompetent perforators. These wounds have a great amount of drainage and are normally partial thickness. Compression is the answer, but only after vascular studies are done to assure good arterial flow. Classified as partial and full thickness wounds

Healing Cycle

Wound healing is an intricate, complex and dynamic process in which the skin or another organ-tissue repairs itself after injury. It is a series of events that occurs from the time of injury and continues with the wound closing. The importance of the body completing this process is to prevent infection and repair the area of damage. The science of wound healing has set aside this action into phases. Although different, the main actions often overlap from one phase to the next. The difference from a chronic wound and acute wound is the length of time from opening to closing. The causes for

increased healing can be related to comorbidities, infection, and improper care of the healing tissue. A recent query for “phases of wound healing” in PubMed retrieved 1601 records. Under the search query, “wound healing and repair,” 1 article was identified in PubMed in 1899. In 1989, there were 101 articles and in 2019 there are over 100,000 related articles. As our understanding of wound healing progresses, further phases and subphases may well be delineated. Therefore, it is important to understand what the body is doing as the wound progresses from through the phases.

Phase 1 - Hemostasis Phase

Just like when damage has occurred during a natural disaster, it takes a team, with specific jobs to rebuild the community. So too, with wound healing.

First responders, with specialized skills take care of the most crucial situations, sealing off dangerous areas. In wound healing, damaged blood vessels must be sealed. In the healing cycle, platelets are the cells that act as the “first responders” sealing off the damaged blood vessels. The fibrin clot is used to create the foundation for cells to move across. The many reactions of hemostasis are as follows:

- Invasion of normal bacteria from the skin into the wound, causing the body to produce white blood cells.
- Fibrinolysis - the breakdown of the fibrin clot to further cell migration and move to the next phase of wound healing

Phase 2 - Inflammatory Phase

In the wound healing analogy, the next job to be done once the “dangerous areas are sealed” is to clean up the debris. This is a job for the ‘clean-up crew’. These non-skilled laborers in a wound are the neutrophils or PMN’s (polymorphonucleocytes).

The inflammatory response causes the blood vessels to become leaky releasing plasma and PMN’s into the surrounding tissue. The neutrophils “eat” debris and harmful foreign particles such as bacteria, and dead or dying cells. This provides the first line of defense against infection. They are aided by local mast cells.

As fibrin is broken down as part of this ‘clean-up’, the degradation products attract the next cell involved. The task of rebuilding a community is complex and requires someone to direct this activity like a military commander. The cell which acts as “commander in charge” in wound healing is the macrophage. Macrophages are able to eat bacteria and provide a second line of defense. This phase is noted with increased warmth, redness and edema. This is not to be confused with the first

signs of infection.

To identify infection is to know the signs and symptoms. Pain is an important factor along with warmth, redness, erythema, edema, changes in drainage and in wound measurement to name a few. During this time of wound healing the following are taking place:

- Increased fluid into the area with the breakdown of the fibrin clot, the increased permeability of the vessels and activation of the complement system.
- The complement system continues the destruction of bacteria by working with the white cells.
- The release of cytokines that increase the repair process by increasing cell proliferation, migration, matrix synthesis, and inflammatory response.

Phase 3 - Proliferation/ Repair Phase

In the wound healing analogy once the site has been cleared of debris, under the direction of the commander, builders move in to construct the new community. Other team members can now install new infrastructure. The fibroblasts that secrete the collagen frame further dermal regeneration. In this phase of wound healing there is formation of granulation tissue and filling in of the wound bed, from the base to the top. During this phase the surgical patient is at a high risk of dehiscence. The following is happening during this time of wound healing:

- There is decreased tensile strength related to formation of Type III collagen by fibroblasts.
- Increased need for protein for the growth factors and angiogenic factors. Angiogenesis is the formation of new capillaries and repair of injured capillaries.
- Formation of the extracellular matrix that is used by the granulation tissue to move from one side of the wound edges to the other side.
- Epithelialization is the movement of cells across the extracellular matrix
- Wound contraction is movement of the wound edges closer with the use of fibroblasts and myofibroblasts.

Phase 4 - Remodeling/ Maturation Phase

Once the basic structure of the community is completed interior structure may begin. So too in wound repair, the healing process involves remodeling. In this phase the wound is moving to finish closure and rebuilding of tissue inside of the wound bed. This phase can take up to one year to complete and the wound will remain only 70% to 80% as strong as the original tissue.

- There is a replacement of granulation tissue, made up of fibroblasts and myofibroblasts to replace with collagen tissue and increase tensile strength
- Scar formation that is neither vascular nor cellular, that is made up of collagen and used to increase tensile strength.
- Remodeling, when completed, will increase the tensile strength to only 70%-80% that of the original tissue.

Although various categories of wound healing have been described, the ultimate outcome of any healing process is repair of a tissue defect.

Key Points

The definition of acute wound and chronic wound has changed many times over the years of research. Recent research defines acute as progressing in an orderly, rapid, uncomplicated, and organized fashion. Chronic would be the opposite including the following: increased chance of infection, buildup of bioburden, and a drain on economy and patient quality of life. To understand each phase and be aware of changes that must occur is to decrease the cost of healing and increase the quality of life for the patient.

Phase 1 is important to stop the body from continually bleeding and bring in the white cells to fight bacteria that have entered through the outside skin. It is important to maintain homeostasis and start the continuum of wound healing.

Phase 2 is a continuation and the start of the inflammatory phase. This is where the white cells control the number of bacteria in the wound. In this phase the wound must be observed for differences between normal signs and symptoms of this phase and signs and symptoms of infection. The increase in pain, a noted fever, and increase in the size or no changes in the size of the wound, would indicate an infection.

Phase 3 is important because this is where the wound continues to fill-in and begins true healing. There is movement from the base of the wound to the top. There is a filling in with granulation tissue and collagen matrix to complete the healing process. There is an increase in protein need during this phase to help with the building of the matrix.

Phase 4 is completing the healing cycle with scar formation and the exchange of fibroblasts for myofibroblasts. The importance in this phase is regrowth, increasing tensile strength and completion of wound healing.

Identification of Infected Wounds

Our skin has many microorganisms present

and the skin is considered colonized by natural flora. When the skin is broken and a wound is present, the microorganisms can then enter to deeper areas of tissue and start multiplying. It is the progression from colonized to infected that must be monitored by patient, caregiver and nurses with each dressing change. When the wound is critically colonized or infected, then often there is a need to address the problem and bring the wound back to the colonized level. The control of microorganisms is done by use of dressings and antibiotics. When there is definite indication of deep tissue infection the standard of care is to do a culture of the wound bed. Best practice of wound cultures is to be sure the wound is well cleansed, free of necrotic tissue and performed to collect only the wound bed.

Colonized is a movement of bacteria into the wound bed with some microorganisms starting to multiply, without overt signs of infection.

At this time the wound bed is not infected nor is the normal wound healing interrupted.

One-way to think of this: The city people are happily living together without one person being stronger than another.

Critically colonized is an increase in the number of microorganisms and the body will respond by progressing back to the immune phase. The microbes in the wound are growing faster than they're dying, delaying healing. This type of wound lacks clinical signs of infection, despite supporting a bacteria level close to the maximum level the patient can tolerate. The patient's immune defenses are simply not strong enough to prevent the wound moving from one stage to the next.

"In essence, the critically colonized stage is the calm before the storm. By recognizing trouble now, you can initiate appropriate treatment before the balance is tipped further and deeper tissue infection occurs" – Connie Sarvis, RN, CON(C), CWD, IIWCC, MN, FCCWS

There is no need for oral antibiotic as much as use of an antimicrobial dressing to help support the continuation of wound healing. One of the indications there is **infection** present is the lack of wound progression.

The mnemonic **NERDS** by Baranoski & Ayello, 2012 explains the best the signs and symptoms to monitor:

N = non-healing wound

E = exudative wound or change in the exudate coming from the wound by amount and color

R = red and bleeding wounds or a change in the tissue in the wound bed, where the wound bed bleeds easily

D = debris found in the wound bed, or necrotic tissue

S = smell/odor emanates from the wound

that is not related to the type of dressing being used. When these symptoms occur, the wound is a local infection and the patient is NOT symptomatic.

An **infected wound** is present when the number of microorganisms causes tissue damage and often a systemic reaction by the body.

The systemic reactions include an increase in skin temperature as well as body temperature.

The mnemonic **STONES** by Baranoski & Ayello, 2012 is as follows:

- S** = size is bigger
- T** = temperature increase in the patient and area surrounding the wound
- O** = osteomyelitis; that is, you can probe to the bone; exposed bone or can feel bone in the wound
- N** = new areas of breakdown
- E** = exudate, erythema, edema present surrounding the wound and coming from the wound
- S** = smell that can not be associated with the dressing

When there is a systemic or deep tissue infection, then the wound must be addressed with antibiotics therapy and can also include anti-microbial dressing.

At this time a culture needs to be done to the wound bed to assure a proper antibiotic is being used to control the bacteria present.

Cultures should be done on cleaned wound beds only and in a Z-pattern being sure to cover the whole wound bed. Once an infected wound has been identified, a detailed assessment must be completed to determine the extent of problem, and get to the depth of the issue.

Pressure Injuries

Pressure injuries are defined by the National Pressure Ulcer Advisory Panel (NPUAP) as localized damage to the skin and/or underlying soft tissue usually over a bony prominence or related to a medical or other device. A medical device could include oxygen tubing, catheters, and casts. The damage is caused by a lack of oxygen and blood flow. When oxygen and blood flow are stopped from an area of tissue there is death of cells and breakdown will occur if pressure is not relieved. That is why off-loading is very important for the prevention and cure of pressure injuries.

Pressure injuries are a significant cause of increased mortality and morbidity, physical disfigurement, and prolonged hospitalizations and are one of the costliest preventable problems for long-term care residents. Each year, more than 3 million people in the United States develop pressure injuries. The cost of

pressure injury treatment and chronic wound care in the United States are estimated to be in the tens of billions of dollars on an annual basis. In past studies more than a decade old there has been wide variability of statistics. It had been reported that in acute care settings in the United States, the incidence of pressure injuries is 0.4% to 38%; within long-term care it is 2.2% to 23.9%, and in-home care, it is 0% to 17%. In a research study reported in 2019, in the International Wound Journal, it was estimated that 8.3% of acute care patients develop hospital-acquired pressure injuries (HAPI) at an incremental cost to hospitals of over \$10,000 per patient.

People who are immobile are at highest risk of developing pressure injuries. The Braden Scale for Predicting Pressure Injury Risk is the assessment tool most often used in home healthcare, nursing homes and hospitals. With the Braden Scale the patient is assessed for the following six areas: sensory/cognitive perception, moisture, activity, mobility, nutrition, and friction and shear will be discussed in detail.

Risk Factors

Anyone with limited mobility is at risk of developing pressure injuries. Immobility may be due to:

- Generally poor health or weakness
- Paralysis
- Injury/illness that requires bed rest or wheelchair use
- Sedation
- Recovery after surgery
- Coma

Additional Risk Factors

Age. The skin of older adults is generally more fragile, thinner, less elastic and drier than the skin of younger adults. Also, new skin cells are usually generated more slowly. All of these conditions of the skin make it more vulnerable to damage.

Lack of sensory perception. Spinal cord injuries, neurological disorders and other conditions can result in a loss of sensation. An inability to feel pain or discomfort can result in not being aware of bedsores or the need to change position.

Weight loss. This is common during prolonged illnesses, and muscle atrophy and wasting are common in people living with paralysis. The loss of fat and muscle results in less cushioning between bones and a bed or wheelchair.

Poor nutrition and hydration. An adequate amount of fluids, calories, protein, vitamins and minerals in the daily diet are important for maintaining healthy skin and preventing the breakdown of tissues.

Urinary or fecal incontinence. Problems with bladder control can greatly increase the risk of pressure sores because the skin may frequently be moist, making it more likely to break down. Bacteria from fecal matter can cause serious local infections and lead to life-threatening infections affecting the body in general.

Excess moisture or dryness. Skin that is moist from sweat or excessively dry is more likely to be injured in general and increases the friction between the skin and clothing or bedding.

Medical conditions affecting circulation. Because certain health problems, such as diabetes and vascular disease, affect circulation, parts of the body may not receive adequate blood flow, increasing the risk of tissue damage.

Smoking. Smoking impairs circulation and reduces the amount of oxygen in the blood. Therefore, smokers tend to develop more severe wounds, and their wounds heal more slowly.

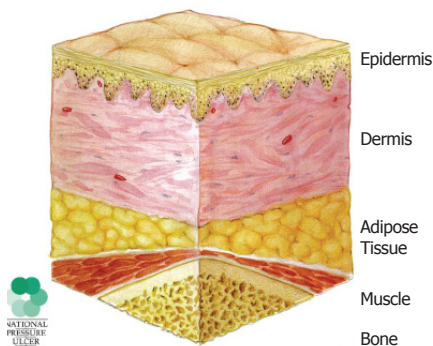
Decreased mental awareness. People whose mental awareness is lessened by disease, trauma or medications are often less able to take the actions needed to prevent or care for pressure sores.

Muscle spasms. People who have muscle spasms or other involuntary muscle movement may have an increased risk of wounds from frequent friction or shearing.

Causes

Pressure injuries are likely caused by three different tissue forces:

1. **Pressure,** or the compression of tissues and/or destruction of muscle cells. In most cases, this compression is caused by the force of bone against a surface, as when a patient remains in a single decubitus position for a lengthy period. After an extended amount of time with decreased tissue perfusion, ischemia occurs and can lead to tissue necrosis if left untreated. Pressure can also be exerted by external devices, such as medical devices, braces, wheelchairs, etc.
2. **Shearing,** a force created when the skin of a patient stays in one place as the deep fascia and skeletal muscle slide down with gravity, can also cause the pinching off of blood vessels which may lead to ischemia and tissue necrosis. Friction is related to shear but is considered less important in causing pressure injuries.
3. **Microclimate,** the temperature and moisture of the skin in contact with the surface of the bed or wheelchair.



Normal

Used with permission of the National Pressure Ulcer Advisory Panel 11/2013 © NPUAP

Moisture on the skin causes the skin to lose the dry outer layer and reduces the tolerance of the skin for pressure and shear. The situation may be aggravated by other conditions such as excess moisture from incontinence, perspiration, or exudate. Over time, this excess moisture may cause the bonds between epithelial cells to weaken, thus resulting in the maceration of the epidermis. Temperature is also a very important factor.

Pathophysiology of Pressure Injuries

Pressure injuries may be caused by inadequate blood supply and resulting reperfusion injury when blood re-enters tissue. A simple example of a mild pressure injury may be experienced by healthy individuals while sitting in the same position for extended periods of time: the dull ache experienced is indicative of impeded blood flow to affected areas. Within two hours, a shortage of blood supply (ischemia) may lead to tissue damage and cell death. The injury will initially start as a red, painful area. The other process of pressure injury development is seen when pressure is high enough to damage the cell membrane of muscle cells. This is the deep tissue injury form of pressure ulcers and begins as purple intact skin.

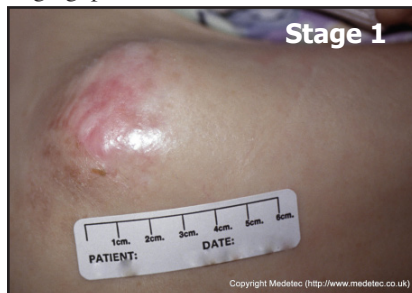
Staging of Pressure Injuries

NOTE: Only pressure injuries are staged. All other ulcers (wounds) are partial or full thickness, including incontinence-associated damage.

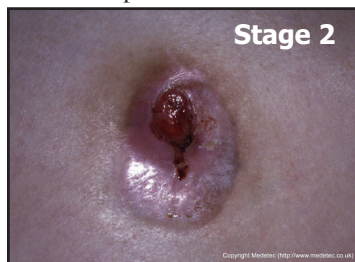
A pressure injury that is not off-loaded will not heal properly. A venous stasis wound that is not compressed to rid the area of extra fluid will continue to not move through the healing cycle and can even increase in number and size. An arterial wound that lacks blood flow, does not have enough oxygen to promote

proper wound healing. With this in mind, the stages of wounds are as follows:

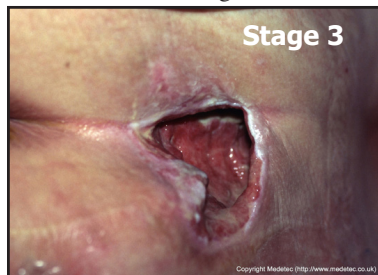
- **Stage 1** (partial thickness) is defined as a reddened area or non-blanchable erythema over a bony prominence. This area can be painful, firm, soft, warmer or cooler as compared to surrounding tissue. This damage can be difficult to assess in dark skin individuals. The first interventions to put in place would include the following: turn and reposition every two hours, appropriate chair cushion with position changing, protection with moisture barrier.



- **Stage 2** (partial thickness) is the removal of the first two layers of tissues from the epidermis and includes the dermis. This includes a fluid or serosanguineous filled blister - most often without slough or bruising and as a shiny or dry shallow ulcer. This wound will heal by epithelialization and will need protection from moisture and pressure relief.



- **Stage 3** (full thickness) is defined as progressing to subcutaneous fat layer. There is NO visualization of bone, tendon or muscle. Injuries that progress this far, even when healed, remain as Stage 3 injuries. These injuries will qualify for specialized mattresses to assure proper off-loading if located NOT on the legs or below or neck or above. The injury may have slough, tunnels (sinus tracts) and undermining. Easy rule of thumb, if you feel a bone this is a Stage 4.

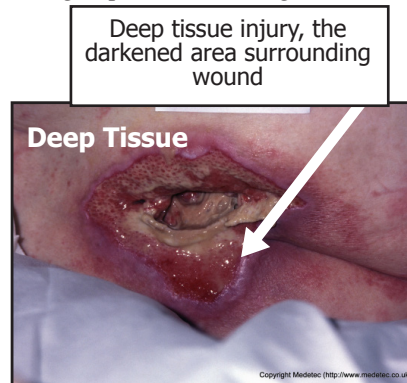


- **Stage 4** (full thickness) is defined as damage to tissue that has proceeded to expose the bone. Slough, eschar, tunnels and undermining

may be present. When bone is present there is increased risk of osteomyelitis. These injuries often need surgical intervention. The patient needs to be monitored for nutritional needs, support surface needs and assure proper dressings are applied.



- **Deep tissue injury** is a injury located over a bony prominence that has progressed to deep in the tissues. This injury is maroon, purple, dark in color or blood filled blister. The tissue is damaged through many layers of skin and can breakdown quickly. The damage is related to lack of oxygen and blood flow to the area for long periods of time. The intervention must include pressure relief and protection from moisture. This injury does not heal, and continued support will be needed to include teaching of patients and caregivers.



- **Unstageable** injuries are covered with slough or eschar and the base of the injury is not visible. An injury that has 60 to 100 percent full thickness tissue loss is considered unstageable. Before the injury can start to heal the tissue needs debridement, including surgical, to assure an injury bed that can support proper injury healing. Injuries with stable black eschar on heels and feet do not need debridement and need to remain dry, off-loaded and protected from moisture that could cause increased infection.



- **Medical Device** 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. The injury should be staged using the staging system.

• **Mucosal Membrane Pressure Injury** is a pressure injury that is found on mucous membranes with a history of a medical device in use at the location of the injury. Due to the anatomy of the tissue these ulcers cannot be staged.

Other Types of Ulcers

Arterial Insufficiency ulcers are serious in nature and difficult to heal. A thorough health history is needed and noted problems with skin, pain and patient history should be included. These ulcers are located on lower legs and feet, are often caused by trauma or infection. Arterial wounds are normally pale in color, have distinctive borders, pale gray or yellow in the base. Often these ulcers are deep, showing tendons, bones, fascia, muscles and joint structures in the ulcer. With ischemia present, the ulcer cannot heal or complete healing. These ulcers can lead to gangrene or tissue necrosis. Testing needs to be complete with the assessment to include the following: capillary refill, bringing the leg to 45 degree equals ischemia, loss of hair on legs and feet, and thickening of nails. Often these patients need to have follow-up studies done, to assess the possibility of increasing blood flow to the area.

The following are three examples of arterial insufficiency ulcers:

1. Partial thickness-the first two layers of skin.



2. Full thickness - below the first two layers of skin, including down to bone.



3. Unable to assess or give a thickness related to eschar - unable to visualize the wound bed.



Venous insufficiency is related to the inability of the venous system to return blood back to the heart. The superficial veins communicate with the deep veins via perforator veins. If you imagine the two legs of the letter “H”, the perforator vein is the connection between the two legs of the letter “H”. That “connection” is the part that perforates the muscle fascia and connects the deep veins to the superficial veins. With this said, incompetent perforators, decrease muscle strength and enlarged veins are the reasons for the insufficient venous return. There is also an increase chance of infection and skin breakdown. The slightest amount of injury to the skin and/or increased pressure on the surface of the skin will create a wound that will not heal appropriately. These wounds below are located on the pretibial and medial supra-areolar areas of the ankle. In doing a physical assessment it is noted that the legs have a hemosiderin appearance, edema, varicose veins, and lipodermatosclerosis. In assessing these ulcers it is important to assess the lymphatic and arterial systems as well. In order to heal these ulcers, compression is the gold standard and should not be used unless it will not affect the arterial system.

The following are three examples of venous insufficiency wounds:

1. Partial thickness is the first two layers of skin and heal by epithelialization.



2. Full thickness is past the first two layers of skin and can go to the bone. This thickness would heal by granulation.



3. Cannot assess the extent of the wound

because wound base unobservable.



Diabetic Foot Ulcers are the more serious and can lead to the increase chance of amputation. Most often causes of open areas are from improper shoes, walking barefoot, and accidents. The risks include the following: loss of blood flow to the feet, neuropathy, and uncontrolled blood sugar. Diabetics often have foot deformities including Charcot foot, which is the widening of the foot including misshaping from the breakdown of bones. It is very important to teach these patients to never go barefoot and check feet on a daily basis. Must be aware that diabetic patients can become septic with infection easily. Diabetics rarely run a fever but will have increased blood sugar readings if there is infection. An exposed bone will often equal osteomyelitis and should not mean amputation.

The following are three examples of diabetic foot ulcers:

1. Partial thickness is the first two layers of skin and heals by epithelialization.



2. Full thickness is beyond the first two layers of skin and can go to the bone. Vigilant care, hyperbaric oxygen therapy and antibiotics are a must with exposed bone.



3. Unable to assess wound related to non-viable tissue present and cannot visualize the base of the wound.



Traumatic wounds are best defined as wounds that occur as a result of cuts, burns, abrasions, motor vehicle accidents, gunshot, or animal bites. Some trauma wounds are simple lacerations and will heal by primary intention depending on location and type. Skin tears would be considered simple lacerations, unless not able to reuse the flap, and then becomes a chronic wound. Extensive lacerations need debridement and sometimes multiple debridement to reach tissue that is healthy. Wounds not closed after six hours of injury are considered contaminated and will not heal by primary intention. The importance in traumatic wounds is full patient assessment to assure knowledge of how the trauma occurred and how best to promote healing.

The following are three examples of traumatic wounds:

1. Partial thickness is just loss of the first two layers of skin.



2. Full thickness is the loss of all layers of skin to include bone.



3. Unable to assess the depth of the wound base related to the amount of non-viable tissue.



Surgical Wounds are described as wounds that have not healed by primary intention. These surgical incisions because of extrinsic and intrinsic causes will need to heal by secondary or tertiary intention. When assessing a surgical wound, there needs to be a full assessment of the patient and reason for the surgery as well as the comorbidities of the patient. The assessment of the incision line assures that the incision has healed properly from the base of the surgical line to the surface of the skin. If the surgical line dehisced, it will be a full thickness wound since most surgery involves all layers of the skin. Partial thickness wounds would only include the first two layers of skin.

The following are two examples of surgical wounds:

1. Full thickness surgical wound.



2. Incision that has dehisced and runs along under the suture lines. Unable to assess depth related to the non-viable tissue present.



Key Points

The most common types of ulcers include: Pressure injuries, venous insufficiency, diabetic ulcers, arterial ulcers and surgical ulcers. Atypical wounds, though not common, do often occur. These wounds are related to uncommon location, appearance, and do not respond to conventional therapy. These factors are important when deciding what is best for the patient and healing the wound.

Pressure injuries are located over bony pressure areas and are stage related to the depth of the wound bed. Stages include the following:

- **Stage 1** - reddened area that does not go away immediately but will when off-loaded for 30 to 60 minutes.
- **Stage 2** - first 2 layers of skin, superficial in nature.
- **Stage 3** - down to the fascia of the wound bed.
- **Stage 4** - down to the bone and including the bone.
- **Non-stageable** - is related to not visualizing

the wound base because of necrotic tissue. Deep tissue injury is pressure-related injury to subcutaneous tissues UNDER intact skin that has potential for rapid deterioration.

- **Deep Tissue Injury** - purple to deep red in color, not open and damage includes to bone.
- **Device related pressure injury** - includes injuries that are related to pressure from devices that include: air tubing, cpap masks and catheters to name a few.
- **Mucosal pressure injury** - over mucosal layers of skin, including mouth, anal area that are not staged and device related.

Leg wounds can be venous insufficiency, arterial insufficiency or both. Venous insufficiency wounds that are located between the knee and the ankle, have a lot of drainage, ruddy in color, not painful and irregular in shape. Arterial insufficiency wounds are located from the ankle to the foot and have little to no drainage, pale granulation, painful, and round in shape. With the venous insufficiency compression is the only way to increase healing and three to four layer compression is the gold standard. Before doing compression there must be arterial studies done to assure that there is good blood flow. With arterial wounds, there needs to be medical intervention to increase arterial flow or the wounds will not heal.

Diabetic wounds are the hardest and most difficult wounds to heal. There are many problems with healing diabetic wounds and they are as follows: possible arterial insufficiency, neuropathy, uncontrolled blood sugars, increased infection rate, and slow wound healing. These patients need teaching related to the signs and symptoms of infection for diabetics, importance of blood sugar control and arterial studies. All comorbidities need to be addressed along with the wound and diabetes.

Traumatic wounds are the result of injury to the area, not to be confused with skin tears. Traumatic wounds can be complicated by comorbidities but not caused by them. For example: a diabetic has a stab wound, it will heal more slowly as a result of uncontrolled blood sugar. A traumatic wound can be the result of: gunshot, stabbing, burns, motor vehicle accidents, abrasions, and animal bites to name a few. These patients have the wound and the emotional problems as well. These patients need emotional support as well as the physical support of healing the wound. These wounds are either full thickness or partial thickness.

Surgical wounds are the result of an incision that did not heal correctly. This healing is complicated by infection or comorbidities. The total assessment of the wound for undermining and tunneling is important to assure that under the incision no pockets or open areas will be left when healing. Most surgical wounds are

best for Negative Pressure Wound Therapy (NPWT). These wounds are either full thickness or partial thickness.

Wound Assessment

The first assessment needs to include a full head to toe assessment including how the patient views the wound and views his/her quality of life. Questions such as: "What is your plan for the future?", "How do you feel about your wound or what you view as important at this time?", and "What do you see as the priority to your treatment at this time?" Many professionals forget the patient assessment when assessing the wound.

Direct wound assessment is important to indicate progression of the wound, detrition of the wound, and support for the dressings being used. The visual assessment and verbal subjective history from the patient, as well as full assessment of the wound will assist with a positive outcome and will aid in the diagnosis of the type of wound. It is important to understand that wounds can be caused by pressure (most common), venous/arterial insufficiency, surgery, trauma, and diabetes.

Measuring and Assessing Ulcers and Wounds

The importance of measuring and assessing ulcers and wounds is the need to document progress of healing, or lack of progress. They need to be measured weekly and inform physicians of any changes noted. The assessments must contain the following information: type, anatomic location, age, size, shape, stage, sinus tract, tunneling, undermining, fistula, exudate, sepsis, surrounding skin, maceration, edges, epithelialization, necrotic tissue, tissue inside of the wound bed, and pain assessment. The need to do a complete assessment is stressed by the government so that a written plan of care is supported by the assessment.

When assessing the patient with or without a wound it is important to understand the patient's risk of developing a pressure ulcer. With many changes in government regulations, it has become important for hospitals, skilled nursing home facilities, home care agencies and transitional care companies to specifically and thoroughly document wound-healing progression.

The Braden Scale

The Braden Scale is the best way to assess the patient and the potential risks of developing a pressure ulcer. It is a summary rating scale made up of six subscales.

As a tool for accurately predicting a patient's

risk for a pressure wound, the following six subscales are scored:

1. Sensory Perception
2. Activity
3. Mobility
4. Skin Moisture
5. Nutrition
6. Friction and Shear

Subscale definitions and guidelines are as follows:

Sensory Perception - This is the person's ability to not only know his/her whereabouts but also the ability to feel his/her position or pain in the area.

A score of 1 = Completely limited by answering these questions:

- Does the patient shift weight when sitting too long?
- Does the patient show any emotion related to pain?

A score of 2 = Very limited

- Does the patient only respond to painful stimuli by moaning or becoming restless?
- Does the patient only feel 1/2 of his/her body?

A score of 3 = Slightly limited

- Responds to verbal commands but cannot respond to discomfort or the need to turn?
- Has some sensory impairment that limits ability to feel in one or more extremities.

A score of 4 = No impairment

- No problems with being aware of pain or discomfort of body parts.

Skin Moisture - This is the patient's way to stay dry. Is the patient incontinent, perspire a lot or damp? It is not what can happen before, but at the present time.

A score of 1 = patient is always moist/wet, unable to verbalize that is wet or in discomfort and linens are changed often throughout shift.

A score of 2 = patient is often moist/wet, linen changed once per shift.

A score of 3 = patient is sometimes moist/wet, and linen only changed once per day.

A score of 4 = patient is never moist/wet, and linen does not have to be changed due to moisture.

Activity - The patient can change position often without help from others.

A score of 1 = patient is bedfast.

A score of 2 = patient can move with help from the bed to a chair or wheelchair.

A score of 3 = patient can walk with use of walker, help or for short distances.

A score of 4 = patient has no problems with walking around or getting self out of bed.

Nutrition - is the ability of the person to take in food and nutrients as a part of the daily diet. Able to not only take in enough for daily needs but healing needs also.

A score of 1 = patient is unable to eat or take in any nutrition at this time. If patient is NPO (nothing by mouth) for more than 5 days or on IV fluids.

A score of 2 = patient is unable to take in more than ½ of the nutrients needed for daily calories. The patient is on a liquid diet or receiving tube feedings.

A score of 3 = patient is able to eat more than ½ of meal and eats most of the protein needed to heal body. Is receiving TPN (total parenteral nutrition) or tube feedings that meet nutritional needs

A score of 4 = patient has no problems taking in the calories and nutrients needed for metabolism or healing needs

Mobility - is the patient's ability to move self in bed or change positions.

A score of 1 = patient is immobile, unable to move self in bed.

A score of 2 = patient is limited in ability to move self, does need help repositioning and turning self.

A score of 3 = patient makes frequent body changes on own without help or assistance but are only slight changes.

A score of 4 = patient makes all body changes without problems or assistance

Friction and Shear - is the patient's ability to move self in bed, keeping self from sliding or decreasing the potential of harm related to sliding down in bed.

A score of 1 = patient is not able to move himself/herself up in bed. Once sliding down in bed, needs maximum help getting back up. Contractions, spasticity, or agitation leads to constant friction and increased breakdown in skin. Patient is in restraints or other means of keeping him/her from moving freely.

A score of 2 = patient requires some assistance and can keep position in chair or bed most of the time.

A score of 3 = patient has no problems with friction or shear. No problems getting around.

By scoring these correctly the interventions of keeping the patient from breakdown will be appropriate to help assure no skin breakdown or limited skin breakdown.

Scoring

Scored from 1-4 (1 for low level of functioning and 4 for the highest level or no impairment). Total scores range from 6-23 (one subscale is scored with values of 1-3, only).

The subscales measure functional capabilities of the patient that contribute to either higher intensity and duration of pressure, or lower tissue tolerance for pressure. A lower Braden Scale Score indicates lower levels of functioning and, therefore, higher levels of risk

for pressure ulcer development.

Each functional category in a subscale is rated on a scale of 1 to 4 (excluding the 'friction and shear' category that is rated on a 1-3 scale). This combines for a possible total of 23 points, with a higher score meaning a lower risk of developing a pressure ulcer and vice-versa. A score of 23 means there is no risk for developing a pressure ulcer while the lowest possible score of 6 points represents the severest risk for developing a pressure ulcer.

The Braden Scale assessment score scale:

- Very High Risk: Total Score 9 or less
- High Risk: Total Score 10-12
- Moderate Risk: Total Score 13-14
- Mild Risk: Total Score 15-18
- No Risk: Total Score 19-23

Anatomic Wound Location

Note the exact location of the wound, not the general locations such as hip or buttock.

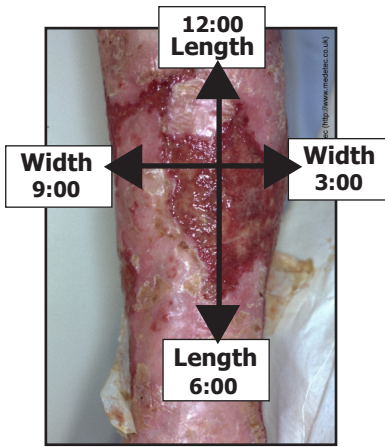
Include the following information for wound location:

- Superior - above a wound or anatomic location
- Inferior - below a wound or anatomic location
- Lateral - outside part of the body
- Medial - toward the middle part of the body
- Anterior - front part of the body
- Posterior - back part of the body

Measuring Wounds

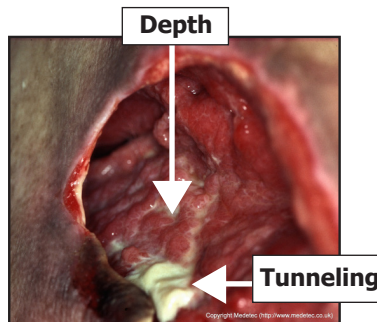
Be sure to include the shape of the wound. Measure in centimeters and not inches. It is important to be consistent in the method in which wounds are measured each time.

The most common method of measurement is the Clock Method in which the wound is considered as a face of clock. The position of the wound is based on standard anatomical positioning of the patient (arms down by the side, palms facing anteriorly, with thumbs facing away from the body), the head being 12:00, the feet at 6:00. Note: on the foot, the heels are at 12:00 and the toes are at 6:00.

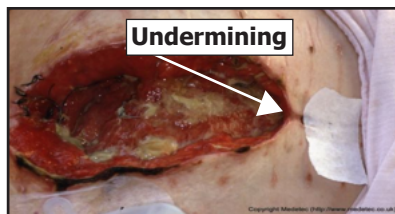


Leg wound measured with Clock Method

- **Length** – head to toe to include time on the clock. If not at the exact 12:00 and 6:00 parts of the clock. Example: The wound length is measured from 1:00 to 7:00 and is 5cm.
- **Width** – Side to side to include time on the clock if not at the exact 3:00 and 9:00 parts of the clock. Example: the wound width measured at 4:00 to 10:00 is 10cm
- **Depth** – Distance from the skin's surface to the bottom of the wound.



- **Tunneling** – Located in the wound bed and going deeper into the bed of the wound or to the side of the wound bed. This indicates infection or unrelieved pressure. Record the deepest depth and location on the clock. Example tunnel is 4cm at 6:00.



- **Undermining** – Located right under the wound edges and is an indication of shear, pulling at the wound bed. Measuring and record the measurements at each time of the clock. Example at 12:00-3cm, at 3:00 2cm, at 6:00-3cm, and finally at 9:00-1cm.

Assess Drainage

To assess the amount of drainage is to look at the dressing and assess the amount of drainage on the dressing. A rule of thumb is: ¼ or less means small or scant, ½ to ¾ is medium and ¾ or greater would be large. An increase in drainage could be one sign of infection but must have all criteria as listed in the section on signs and symptoms of infection.

- **Serosanguineous** is a combination of blood and serous drainage. The drainage would be thin watery, pale red or pink in color.
- **Serous** is clear fluid.
- **Sanguineous** is bloody flow.
- **Purulent** is drainage that is thin or thick and color sometimes yellow or brown. Could be related to type of dressing being used. Wound is in the inflammatory stage of wound healing, or an indication of infection. If there is a concern of infection, then silver could be used for a short period of time.

Assessment of Wound Bed

These tissue types and amounts need to be noted in the wound assessment and needs to add up to 100%. Example: Black Eschar 10%, Yellow Slough 90%.

Granulation tissue in a wound is the indication of good healthy tissue. The tissue is red in color and will continue to move upward.

Hypergranulation tissue is red to pink in color and often rises above the wound bed. It appears bumpy and not as the smooth granulation tissue. This is an indication the cells have too much fluid and the dressing is not pulling the fluid from the wound bed.

Slough tissue is yellow, fibrous, necrotic tissue that is nonviable. This tissue can sometimes be loose and easily removed or adheres to wound bed and need to be debrided. Slough tissue is a collection of fibrin, bacteria, dead cells, and wound fluid.

Black eschar is black or brown tissue that is hard and non-viable. This can be yellow slough that has dried out or tissue that has lost the blood supply to remain healthy. This tissue will inhibit wound closure. The removal of this tissue is needed in most wound locations, except areas on the feet.

The feet are often the first to lose blood supply and debridement will only create a deep wound that will be difficult to heal. The eschar when intact and hard can be covered with a dry dressing or use of an agent that will promote dryness and anti-infecting qualities. The idea is to continue to keep the area dry and intact until healing has completed and the eschar falls off on its own.

Assessment of Wound Edges

Attached edges are normal and indicate the presence of wound healing. The cells will continue across to form wound contraction.

Non-Attached wound edges could indicate the wound bed is surrounding bone; wound that has rolled or epibole, or a wound that is not healing properly. To promote wound healing surgical debridement will be needed.

Wound edges that are not distinct could indicate that the wound bed is at the same level as the edges and epithelialization is occurring.

Calloused wound edges are an indication that there is rubbing or pressure close to the wound and the body is trying to protect the area. To assure good wound healing the edges need debridement or the edges will not allow the wound to close.

Rolled or epibole edges often indicate that the wound has been kept dry and the edges are seeking moisture to finish wound healing. These edges need to be surgically re-opened so that the granulation tissue can continue to move across the wound bed and create an epithelialized wound.

A wound edge that is macerated has white soggy edges. This dressing is not controlling the drainage and if not controlled the edges will breakdown to promote increase in wound size.

Surrounding Tissue Assessment

Hemosiderin staining - Chronic venous stasis changes the skin texture and elasticity that results in a brownish discoloration of the lower legs. This staining occurs when the pressure in the veins causes the red blood cells to break. When the red blood cells break, they leak out hemoglobin. Hemoglobin contains iron, which leaks out into the tissue and stains the skin. This eventually will lead to a venous stasis ulcer.

The skin around the ankle area can no longer adapt to the swelling and breaks open and seeps, leading to a painful venous stasis ulcer.

Erythema - Warmth, increase in pain, and increase in drainage could be indication of infection. Erythema is also present with the application and removal of 3 to 4 layer compression dressing.

Induration - Indicates that the edges of wound have extra fluid around them. This could be related to fluid collection or further breakdown of the edges. This is an indication that the wound has backtracked to phase 1, the inflammatory phase. This could be related to a new trauma or the wound is critically colonized. A silver dressing for 14 days can help to move the wound back to healing. Then return

to a regular dressing that will continue the healing process. Silver dressings should not be the only type used throughout the healing process.

Scar tissue - May be slightly lighter to light pink surrounding, indicating past wounds that have healed recently or quite some time ago. This would indicate a need for teaching and interventions to prevent future breakdown. Scar tissue is only 85% as strong as the original tissue.

Patient Assessment

Assessment of the whole person is as important as the wound assessment. It is Jean Watson that states often in her theory that nursing is assessment of the whole person. Jean Watson stated in her Theory of Caring, "The unity of human mind-body-soul as inseparable one whole". Evidence based-care is based on quality care and including the patient into the creation of care plan for patient centered care". The Braden's score uses some of this information to determine at-risk patients. It is important that the nurse doing the scoring understands the importance of each section and how the scoring will help with prevention.

Age is not a specific scoring on the Braden assessment, but age affects wound healing in several ways: decrease in metabolism, decrease in blood flow, decrease in pain perception, and changes in skin composition. The elderly often have fewer amounts of fat cells, decrease in skin elasticity and decrease in blood flow (especially in the lower legs). The decrease in fat cells creates an increased chance of pressure ulcer and suspected deep tissue injury. The decrease in skin elasticity creates an increase chance of skin tears and trauma wounds. With decrease in pain perception, many patients have the inability to realize when touching hot objects or when running into objects. The decrease in blood flow increases the chance of venous and arterial insufficiency wounds. These patients must be encouraged to remain as active as possible, wear support hose and eat a well-balanced diet. Age is also an indication of how quickly the wound will heal.

Mobility is an important part of the Braden scale and needs to be documented accurately. Braden assesses activity, mobility and friction and shear. First, activity - the degree of physical activity. Is the patient always in bed, confined to chair, walks occasionally or walks frequently? Then Braden includes mobility-how well the patient is able to change and control body position. The scale range is completely immobile, very limited, slightly limited, or no limitation. Finally, the assessment is for friction and shear to include problem, potential problem and no apparent problem. The assessment is important to assure the proper interventions are in place. A patient

with venous insufficiency needs to be assessed for ability to walk put legs up and exercise legs on a daily basis. Physical therapy referral will be important for helping to teach families, work with patients and assure doing what will accurately help the patient to heal.

Nutritional status- Nutrition is an under-assessed, yet important factor in wound healing that is included on the Braden scale. The assessment needs to include intake ratings such as: very poor, probably inadequate, adequate and excellent. The nurses need to look at how the patient has been taking food in by IV or TPN and if NPO for how long, what is being done to assure proper nutrition during that time. Many nurses assume an over weight or obese patient is not in need of nutritional support. Regardless of weight, a patient that is not nutritionally sound will not heal and will become very weak. The most accurate way to assure good wound healing is to know the protein level.

Labs need to include the following: HBA1C-to test blood glucose levels over past 3 months, CBC -to test H & H to assure enough blood cells to carry oxygen to the wound and check white cell count to assess for chance of infection. CMP-to give protein level, albumin level and assure kidney function. The protein and albumin are important to assure that the wound has the essential elements to allow it to move through the phases. There is not one phase of wound healing that the wound will not need protein to complete healing.

Comorbidities are important in the assessment to assure that the whole picture of health is considered in the healing or not healing cycle. A diabetic's blood sugars must be addressed, since an increase from normal would indicate an increase of stress on the body, if that stress is infection, mental or physical. Uncontrolled blood pressure or chronic heart failure causes increased fluid in the legs and decreased healing. A patient with a diagnosis of pneumonia, upper respiratory infection, and urinary tract infection for example are prone to have slower wound healing, since the body is working on healing the general infection and not able to work on healing the wound. All this information needs to be taken into the assessment to assure a true picture of the patient is recorded. There needs to be an assessment of the medications, since some medications interfere with wound healing.

Assessment of Bowel and Bladder is important and addressed in the Braden scale. The importance to note is incontinence, even if that incontinence is temporary. A patient with C. difficile is going to have a stronger increase in breakdown than a patient who is incontinent of bowel and bladder. Diarrhea, especially C. difficile, is extremely harsh to the skin.

Mental state and acceptance of the wound address the stress that wound healing can have on the patient. The more stress and anxiety the patient feels, the more the wound decreases in the healing process. When a patient faces stress, it is a normal body response to go into fight or flight mode. Increased blood sugar pulls oxygen away from the legs and arms, and increases mental alertness. This will decrease important needs the wound has to move through the stages of healing. Depression and stress are elements that need to be monitored to assure homeostasis and proper healing.

Pain needs to be addressed at all times of dealing with the wound assessment and each visit. An increase in pain would be an indication of infection. Pain with the dressing change would indicate the need to have medication. An increase of change in the pain of the wound needs to be addressed and then an increase in temperature needs a call to the physician immediately.

Assessment of medications is important, since many medications can interfere with wound healing and others promote oxygenation to enhance wound healing. By knowing the effect of medication on the body, can either increase wound healing or decrease wound healing, depending on the drug interactions. It is important to know what the drugs do in the body and how that will affect the healing process. The following medications need to be looked at closely for the following reasons:

- steroids and anti-inflammatories interfere with the immune response
- anticoagulant decrease the body's ability to produce fibrinogen
- vasodilators increase blood flow, vasoconstrictors will decrease wound healing,
- antiseptics inhibit wound healing by decrease collagen formation
- vitamin C is used in collagen formation

Key Points

It is very important to do a thorough assessment of the wound and patient on admission, then throughout the wound healing process. Wounds are as complex and different as the patient. The wound does not heal the patient, but the patient heals the wound. Use the anatomic location when describing the wounds location. Measuring the wound needs to include the following: tunnels, undermining, depth, width, and length. When describing, include location by use of time on the clock. Drainage needs to be described to include amount and type. Wound edges, pain, and shape of wound need to be described.

The wound assessment is not complete without a picture of the patient and history of the wound. This would include comorbidities,

medications, age, level of mobility, pain, mental status, nutritional, and spiritual status. The head to toe assessment assures knowing the patient thoroughly and patient then becomes a more than just a wound.

Braden Scale - though there is a bit of a learning curve such that some may consider it difficult to use and understand, it is one of the most used of the assessment scales for predicting pressure ulcer risk.

Wound Dressing Choices

A proper dressing is difficult to choose at times. There needs to be an assessment of both the wound and the patient. There needs to be an understanding of what is in the dressing and what the dressing will do for the wound. Be sure to talk with the patient about any allergies and be sure the dressing being chosen does not have any products that would cause an allergic reaction. Always remember the following: 1. Protocols are great as guidelines; not just one dressing will work on all patients. 2. Moist wound healing is not just a slogan, but is evidence-based care, and 3. The longer the dressing remains in place the faster the wound heals.

The treatment decision must be based on the following acronym **MEASURES**.

M = Minimize trauma

E = Eliminate dead space

A = Assess and Manage exudate

S = Support the tissue defenses

U = Use of nontoxic wound cleansers,

R = Remove infection, debris, and necrotic tissue,

E = Environment to assure moisture dressing and control of outside environment to wound,

S = Surrounding tissue is supported with decrease in chance of continued breakdown.

There are many products in the market today that promote wound healing within and through the phases of healing. There are also websites, organizations and applications that enable communication with wound care professionals throughout the world. Take time to learn beyond the basics as the landscape for available wound care products and published research evolves. Remember when possible, generic names should be used when writing dressing orders and be sure the patient will have the ability to afford the dressing.

Primary Dressing- are the dressings closest to the wound base. This dressing is responsible

for creating that moist wound healing. It will either give moisture to the wound or absorb the amount of drainage in the wound.

- **Alginate** - Fibers derived from brown seaweed or kelp. Available in a pad or a rope and can be impregnated with calcium, silver, or honey. These dressings become a gel when in contact with exudate. Good for medium to high draining wounds. Will provide hemostasis in bleeding wounds. Good for wounds with tunnels, undermining and depth. Can be left in place from 2 to 7 days.

- **Collagen** - Derived from bovina, equine, porcine, and/or avian sources. This dressing is a pad, sheet, particle, powder, and/or alginate and will sometimes have silver added. Can be used with moderate to high drainage wounds. Can be used in the undermining of wounds to help with granulation. Not good for wounds with greater than 1 cm depth. Designed to remain in place for a week and can be changed every 3 days if needed. Collagen will disappear into the wound bed.

- **Hydrogel** - Glycerin and water based, hydrogels are available in gauzes, gels and sheets and can be impregnated with silver or collagen. This product is used for dry wounds and can be used in place of wet to dry dressing, since can be remain in place for 2 to 3 days.

Secondary Dressing- are dressings that cover the secondary dressing. This dressing is responsible for protecting the wound from contamination when the primary dressing can not.

Foam- is a hydrophilic polyurethane or gel film-coated foam absorbent wound dressing. This can be non-adherent, adhesive, absorbent, and silver coated. Frequency depends on the amount of drainage. It can remain in place for 7 days.

Advanced Therapies

This category includes all those dressings, procedures and modalities that are not considered dressings but used in wound care.

- Tissue engineered skin substitutes that are used to help wounds to epithelialization - Two types are Apligraf and Dermagraft, which are engineered from baby foreskin. These are very expensive and need protection until finish healing. These are applied in doctors' offices or wound clinics. The wound will need debridement and the skin substitutes will have stitches or staples to keep in place. A contact layer will be placed to protect the dressing and will need to be monitored for infection with each dressing change. Use or lack thereof is often related to reimbursement issues and cost.
- Cellular and tissue-based products are

nonviable cells, tissue-based human, tissue-based animal, viable human cells, non-cultured intact tissue, viable human cells, cultured in vitro, animal substrate, viable human cells, cultured in vitro, animal substrates, viable human cells culture in vitro, synthetic substrate. Wound must be granulating and free from infection. Be sure to pay attention to shelf life and storage.

- Amnion-based graft products are cells created from umbilical cord and amniotic sacs, in the afterbirth from human birth. While traditionally used for burns, their use has expanded to include use in the wound bed of deep wounds. Proper directional placement of an amnion membrane's stromal collagen layer facing the wound base is important
- Negative-pressure wound therapy (NPWT or wound vac) is a technique that creates healing by creating a vacuum and moist wound environment with the use of foam dressing and drape covering the area.
- Biophysical technologies include many modalities used in other fields of healthcare and include the following: NPWT, Hyperbaric Oxygen Therapy, Kinetic (including whirlpool, pulsatile lavage), Electronic stimulation, Electromagnetic field, Phototherapy, and Ultrasound (high and low-frequency).
- Compression therapy includes 3 layer and 4 layer compression. The therapy is used on legs primarily for venous insufficiency for the treatment of venous leg ulcers (LVU). One needs to be very careful with application and use of this type of therapy. Arterial status must be known before application. Among others, contraindications include uncontrolled congestive heart failure, abscesses, advanced peripheral neuropathy, and an ankle brachial pressure index (ABPI) of less than 0.8.

Key Points

Dressings are important to wound healing and very often the wound needs re-evaluation to assure proper dressing fits the patient at the time and phase of healing. The patient also needs to be screened for allergies or sensitivities to ingredients used in dressings.

Conclusion

Wound healing represents the outcome of a large number of interrelated biological events that are completed over time, in response to injury and its cellular environment. The immense economic and social impact of wounds in our society calls for allocation of a higher level of research resources to understand biological mechanisms underlying the complexities noted

in problem wounds.

Glossary of Terms

Angiogenesis: The process of producing blood vessels during the granulation phase of wound healing.

Autolysis: The process of breaking down of dead or devitalized tissue with the use of enzymes.

Bioburden: Dead cells and fluid that collects between dressing changes and needs cleaning off the wound bed to allow healing.

Blanching: The reddened area that becomes white with pressure applied.

Cellulitis: The inflammation or infection of skin cells that cause redness, heat, pain and edema.

Charcot: A condition from diabetes where the bones in the feet dislocate, deform or fracture causing the bottom of the foot to have the appearance of the hull of the boat related to the arch collapsing.

Collagen: The protein that is the main component of many major parts of the body and wound healing.

Contraction: Bringing together of wound edges causing the wound size to become smaller. It is important to measure wounds to show healing or deterioration over time.

Detrition: The mechanical process of wearing away by friction.

Epibole: Non-healing wounds with closed, rolled wound edges.

Exudate: Fluid from the wound that can be serous, sanguineous, or purulent.

Fibrin: A protein involved in the clotting process required in the granulation phase of healing.

Fascia: Connective tissue that covers muscle and found throughout the body.

Fibroblast: An important cell used in wound healing.

Friable tissue: The tissue that bleeds easily and can indicate infection.

Granulation tissue: Red healthy tissue with good flow that will continue to heal.

Growth Factors: Proteins that are used to bring cells to an area as well as create other proteins used in wound healing.

Hemosiderin Staining: A staining to lower leg to indicate venous disease. It is caused by the release of iron from disintegrate red blood cells.

Intermittent Claudication: Pain related to poor or compromised blood supply. The pain is acute when walking and decreases with rest. Increase in pain

often happens with leg elevation.

Ischemia: The loss or deficiency of blood to an area.

Lipodermatosclerosis: A skin and connective tissue disease that is inflammation of the fat layer of the epidermis.

Maceration: The whiteness and loss of intact skin around a wound as a result of dressing not able to pull or control excess fluid.

Necrotic tissue: Dead tissue that found in the wound bed as a result of loss of blood flow. This tissue is usually black or brown and leathery.

Off-loading: Taking the weight off the area in order to increase blood flow. Without off-loading suspected deep tissue injury will occur or chronic wound.

Osteomyelitis: Inflammation of the bone; bone infection.

Perforator veins: Veins that allow communication between the superficial venous system and deep venous system of the legs.

Peri-wound: Tissue surrounding the wound. This tissue needs to be assessed for warmth, color or signs of discoloration, to indicate other problems.

Pink tissue: Epithelial tissue can be a shiny pink or white tissue.

Slough: Yellow, stringy, dead cells that can adhere to the wound bed.

Tunneling: Destruction of tissue around the infected area; a wound that has channels extending from the central injury into the surrounding tissue, such as muscle and skin. These tunnels inhibit the wound's healing.

Undermining: The wound is spread out underneath the skin that surrounds the visible part of the wound. The wound is bigger than what it appears at first glance.

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