Pressure Ulcer Prevention and Management

Courtney H. Lyder, ND

PRESSURE ULCERS REMAIN A COMmon problem in all health care settings. It is estimated that 1.3 million to 3 million adults have a pressure ulcer, with an estimated cost of $500 to $40 000 to heal each ulcer.[1,2] The incidence of pressure ulcers varies greatly by clinical setting. Incidence rates of 0.4% to 38.0% for hospitals, 2.2% to 23.9% for long-term care, and 0% to 17% for home care have been reported.[3] Incidence rates of less than 2% are ideal. However, the optimal incidence rate may vary depending on patient case mix, severity of illness, and other contextual factors. Pressure ulcers in elderly persons have also been associated with increased mortality rates.[4] Because pressure ulcers are now considered a good indicator of quality of care, the failure to prevent or heal them can lead to litigation.[5]

Prevention

Pressure ulcers develop when persisting pressure on a bony site obstructs healthy capillary flow, leading to tissue necrosis. It is generally accepted that healthy capillary pressure ranges from 20 to 40 mm Hg, with 32 mm Hg considered the average. However, it is important to note that depending on a patient's severity of illness and comorbidity, less pressure may be required to obstruct capillary blood flow. Pressure ulcers can develop within 2 to 6 hours. Therefore, the key to preventing pressure ulcers is to accurately identify at-risk individuals so that preventive measures may occur.

More than 100 risk factors have been identified in the literature. Some physiologic risk factors include diabetes mellitus, peripheral vascular disease, cerebrovascular disease, sepsis, and hypotension. It has been hypothesized that these physiologic risk factors place the patients at risk because of impairment of the microcirculatory system.[6] Microcirculation is controlled in part by sympathetic vasoconstrictor impulses from the brain and secretions from localized endothelial cells. Because both neural and endothelial control of blood flow are impaired during an illness state, the patient may be more susceptible to ischemic organ damage (eg, pressure ulcers).

Because of the overwhelming number of risk factors, pressure-ulcer prediction tools are widely used.[7] Presently, the Norton Scale and Braden Scale are the most widely used prediction tools. The Norton Scale is composed of 5 broad clinical categories: physical condition, mental state, activity, mobility, and incontinence, with a score of 16 or less indicating increased risk for pressure-ulcer development.[7] The Braden Scale is composed of 6 broad clinical categories: sensory perception, moisture, activity, mobility, nutrition, and friction and shear, with a score of 18 or less indicating increased risk for pressure-ulcer development.[8] Both validated tools use broad clinical categories to identify patients at risk for pressure ulcers, and both tools have a tendency to overpredict the number of patients at risk. Thus, titration of preventive measures based on level of risk (high vs low) is essential to decrease cost and patient and staff burden.

Preventing pressure ulcers requires a complex interaction of interventions. Few preventive measures have been rigorously evaluated. However, there is agreement that excessive pressure for a period of time may result in pressure-ulcer development. Thus, major preventive interventions consist of removing or redistributing the pressure-sensitive areas of the body. A 2-hour repositioning schedule should be the minimum interval for patients at risk.[9]

The use of support surfaces is an important consideration in redistributing pressure (TABLE 1).[10] The use of dynamic support surfaces in high-risk patients has led to improved outcomes and cost savings.[11] The Centers for Medicare and Medicaid Services has divided support surfaces into 3 categories for reimbursement purposes. Group 1 devices are those support surfaces that are static and do not require electricity. Static devices include air, foam (convoluted and solid), gel, and water overlay or mattresses. These devices are ideal when a patient is at low risk for pressure-ulcer development. If foam is used, it should support 19.5 kg/m^3 and measure more than 7.62 cm in thickness. When reactive hyperemia is noted on bony prominences using group 1 surfaces, the use of a dynamic surface should be considered.

Group 2 devices are powered by electricity or pump and are considered dynamic in nature. These devices include alternating and low-air loss mattresses. These mattresses are useful for patients who are at moderate to high risk for pressure ulcers or have full-thickness pressure ulcers. Group 3 devices are also considered dynamic in nature. This classification comprises only air-fluidized beds. These beds are electric and contain silicone-coated beads. When air is pumped through the bed, the beads become liquified. They are

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Author Affiliations: Acute and Specialty Care of Adults, University of Virginia School of Nursing, Charlottesville; and Program for the Advancement of Chronic Wound Care, Yale University School of Nursing, New Haven, Conn.
Corresponding Author and Reprints: Courtney H. Lyder, ND, University of Virginia School of Nursing, McLeod Hall, PO Box 800782, Charlottesville, VA 22908-0782 (e-mail: chl4n@virginia.edu).
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most often used for patients with nonhealing full-thickness pressure ulcers or numerous truncal full-thickness pressure ulcers.

The implementation of comprehensive prevention programs in elderly persons (eg, use of a risk-assessment tool, support surfaces, repositioning schedules, nutrition, staff education) has resulted in significant reductions in pressure-ulcer incidence rates and proven to be cost-effective.[12,13] Although the literature is unclear as to the specific time frame required to implement preventive strategies for pressure ulcers, a recent study suggests that implementing preventive strategies after a 48-hour period from admission may be too late.[14] Thus, preventive strategies should be implemented from initial point of entry into the health care system.

Management

The comprehensive evaluation of a pressure ulcer is the initial step in effective management of the wound. Before an ulcer can be assessed, it should be cleansed using saline solutions, avoiding antiseptics. The comprehensive evaluation of a pressure ulcer should take into account the wound stage (depth) and characteristics (eg, amount of drainage, eschar present). Presently, there is no universal classification system for pressure ulcers. However, the staging system produced by the National Pressure Ulcer Advisory Panel[15] is widely used (BOX).[16]

Several instruments have been developed and validated to assess the healing of pressure ulcers. The 2 most widely used tools are the Pressure Sore Status Tool (PSST)[17] and the Pressure Ulcer Scale for Healing (PUSH).[18] The PSST is composed of 13 wound characteristics (eg, depth, size, undermining, exudate type, edema, etc) that are scored and summed to derive the healing of an ulcer. The advantage of the PSST is that it can be used to assess any chronic wound. However, it requires considerably more time to complete than the simpler PUSH tool. The PUSH tool is composed of 3 wound characteristics (size of ulcer [length and width], exudate amount, and tissue type) that are scored and summed to determine the healing of an ulcer.

Photography should be considered as a part of the pressure-ulcer assessment. If photographs are used in the pressure-ulcer assessment, then consistent methodology in obtaining the photograph is essential. Documenting the distance from which the photograph was taken is extremely important, because different distances may distort the true size of the pressure ulcer; an identification sign with patient identification, date of photograph, and wound location should be captured on the photograph.

Dressings are a major component in management of a pressure ulcer. Currently, it is conservatively estimated that there are more than 300 different dressings marketed for pressure-ulcer care. Maintenance of a moist wound environment is the primary goal of a dressing. Although nongauze dressings are usually more expensive than gauze dressings, less frequent dressing changes, faster healing rates, and decreased rates of infections can make nongauze-based dressings more cost-effective over time.[19,20] It is also important to note that wet- to dry-gauze

Table 1. Selected Characteristics for Classes of Support Surfaces*

Performance Characteristic	Air Fluidized (High Air Loss)	Low Air Loss	Alternating Air (Dynamic)	Static Flotation (Air or Water)	Foam	Standard Hospital Mattress
Increased support area	Yes	Yes	Yes	Yes	Yes	No
Low moisture retention	Yes	Yes	No	No	No	No
Reduced heat accumulation	Yes	Yes	No	No	No	No
Shear reduction	Yes	?	Yes	Yes	No	No
Pressure reduction	Yes	Yes	Yes	Yes	Yes	No
Dynamic	Yes	Yes	Yes	No	No	No
Cost per day	High	High	Moderate	Low	Low	Low

*Reprinted from Bergstrom et al.[10]

Box. National Pressure Ulcer Advisory Panel Pressure Ulcer Staging System*

Stage I

An observable pressure-related alteration of intact skin whose indicators, as compared with the adjacent or opposite area on the body, may include changes in 1 or more of the following: skin temperature (warmth or coolness), tissue consistency (firm or boggy feel), and/or sensations (pain, itching). The ulcer appears as a defined area of persistent redness in lightly pigmented skin, whereas, in darker skin tones, the ulcer may appear with persistent red, blue, or purple hues.

Stage II

Partial-thickness skin loss involving epidermis or dermis, or both. The ulcer is superficial and presents clinically as an abrasion, blister, or shallow crater.

Stage III

Full-thickness skin loss involving damage or necrosis of subcutaneous tissue, which may extend down to but not through underlying fascia. The ulcer presents clinically as a deep crater, with or without undermining of adjacent tissue.

Stage IV

Full-thickness skin loss with extensive destruction, tissue necrosis, or damage to muscle, bone, or supporting structures (such as tendon, joint capsule).

*Reprinted from National Pressure Ulcer Advisory Panel.[16]

dressings are a form of debridement and should not be used on ulcers with good granulation tissue. TABLE 2 identifies the major dressing classifications and recommendations for their usage. The use of newer dressings impregnated with hyaluronic acid and other compounds in the extracellular matrix may prove beneficial in healing recalcitrant pressure ulcers.

Optimal nutrition has been associated with wound healing. Nutrition is important to maintain the body in positive nitrogen balance, thus increasing wound healing. It is important to increase protein stores for patients with pressure ulcers who are malnourished. Little empirical evidence exists regarding that the use of vitamin and mineral supplements (in absence of deficiency) actually aids in pressure-ulcer healing or prevention.[21,22] Therefore, oversupplementing patients who do not have protein, vitamin, or mineral deficiencies should be avoided. The use of enteral and parenteral nutritional support should always be considered when the patient is unable to meet nutritional needs because of the inability to chew or swallow, thus decreasing the absorption of nutrients. However, before enteral or parenteral nutrition is used, a critical review of overall goals and wishes of the patient, family, and health care team should be explored, because there is little support for these methods to significantly increase pressure-ulcer healing.[23]

The integration of adjunctive therapies to assist in the healing of pressure ulcers is increasingly used. Several adjunctive therapies are effective and should be considered when pressure ulcers have failed to make significant improvements in healing during a 3-month period. Adjunctive therapies can be expensive and some therapies may not be covered by insurance.

Some of the most common adjunctive therapies include electrical stimulation, radiant heat (normotherapy), growth factors and skin equivalents, and negative pressure therapy. Electrical stimulation works to increase fibroblasts, neutrophil macrophage collagen, and DNA synthesis, and increases the number of receptor sites for specific growth factors.[24,25] Radiant heat is believed to increase blood flow and promote fibroblasts and other factors associated with pressure-ulcer healing.[26,27] The use of cytokine growth factors (eg, recombinant platelet-derived growth factor BB), fibroblast growth factors, and skin equivalents is currently under study.[28]

Vacuum-assisted closure (VAC) (Kinetic Concepts Inc, San Antonio, Tex) is an adjunctive therapy used to manage pressure ulcers with large amounts of drainage.[29] The VAC uses subatmospheric negative pressure to the surface and margins of the pressure ulcer. The negative pressure assists in removing excessive fluids from the wound, thus increasing localized blood flow and promoting granulation tissue. The VAC is contraindicated for pressure ulcers with suspected osteomyelitis, necrotic ulcers with eschar, and ulcers with exposed blood vessels or organs.

Surgery remains a viable option for full-thickness pressure ulcers. The rate of recurrence of a surgically closed pressure ulcer is relatively high; therefore, the benefits of the surgery must be carefully considered. Common types of surgical repairs include direct closure, skin grafting, skin flaps, musculocutaneous flaps, and free flaps. Prophylactic ischiectomy should be avoided, because perineal ulcers and urethral fistulas are common following this procedure.[30]

Table 2. Dressing Selections

Dressing Classification	Partial-Thickness Skin Loss (Stage II)	Full-Thickness Skin Loss (Stages III and IV)	Light Drainage	Moderate Drainage	Heavy Drainage
Transparent films*	X		X		
Hydrocolloids*	X	X	X	X	X
Alginates	X	X			X
Foams	X	X	X	X	
Hydrogels†	X	X			
Hydrofibers‡		X			X

*May be used on stage I pressure ulcers.
†Indicated for wound beds that are dry to rehydrate them or to rehydrate eschar for debridement.
‡Hydrofiber is a registered trademark of ER Squibb & Sons LLC, Princeton, NJ.

Conclusion

Pressure ulcers remain a major health problem for adults across all health care settings. Many gaps still remain in the understanding of preventing and healing pressure ulcers. Studies indicate that comprehensive prevention programs are effective in reducing incidence rates and can be cost-effective. Thus, prevention is critical to reduce overall health costs. Additional research is needed to determine optimal risk scores and appropriate preventive reponses, and interventions to heal pressure ulcers more quickly. Pressure ulcers remain a multifactorial, complex, and dynamic problem, and physicians remain integral to the prevention and management of this common health care issue.

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For the biologist there are no classes—only individuals.
—Jean Rostand (1894-1977)