

CHAPTER 30—PRESSURE ULCERS

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Pressure ulcers are a serious and common problem for older persons, affecting approximately 1 million adults in the United States. As the population ages, pressure ulcers will continue as a major health care problem. The surgeon general's Healthy People 2010 document has identified pressure ulcers as a national health issue for long-term care, and the Health Care Financing Administration (HCFA; in June 2001 renamed the Centers for Medicare & Medicaid Services) has designated pressure ulcers as one of three sentinel events for long-term care. The prevention and healing of pressure ulcers requires the cooperation and skills of the entire interdisciplinary health care team.

EPIDEMIOLOGY

A pressure ulcer can be defined as any lesion caused by unrelieved pressure that results in damage to underlying soft tissue when the tissue is compressed between a bony prominence and external surface over a prolonged period of time. With aging, local blood supply to the skin decreases, epithelial layers flatten and thin, subcutaneous fat decreases, and collagen fibers lose elasticity. These changes in aging skin and the resultant lowered tolerance to hypoxia may enhance pressure-ulcer development in older persons. Since pressure is the major physiologic factor that leads to soft-tissue destruction, the term *pressure ulcer* is most widely used and preferred over *decubitus ulcer* or *bedsore*.

The incidence and prevalence of pressure ulcers vary greatly, depending on the setting. In the hospital, incidence rates have ranged from 1% to 30%. Higher rates are noted in intensive care units, where patients are less mobile and have severe systemic illnesses. The Fourth National Pressure Ulcer Prevalence Survey found an annual hospital prevalence rate of 10.1%. In the long-term-care setting, incidence and prevalence rates have ranged from 3% to 30%. Less is known about pressure ulcers in home care, but studies have reported incidence rates of 4% to 15% and prevalence rates of 5% to 15%.

The incidence of pressure ulcers not only differs by health care setting but also by stage of ulceration. The stage I pressure ulcer (persistent erythema) occurs most frequently, accounting for 47% of all pressure ulcers. The stage II pressure ulcers (partial thickness loss involving only the epidermal and dermal layers) are second, at 33%. Stage III (full-thickness skin loss involving subcutaneous tissue) and stage IV (full thickness involving muscle or bone or supporting structures) pressure ulcers make up the remaining 20%. Several studies have noted that the incidence of pressure ulcers among black Americans and among white Americans may differ. Blacks tend to have a greater incidence of stage III and stage IV pressure ulcers than whites have. Whether this can be attributed to structural skin changes or socioeconomic factors is unknown because of the paucity of pressure-ulcer research among patients in U.S. minority groups.

COMPLICATIONS FROM PRESSURE ULCERS

The development of pressure ulcers can lead to several complications. Probably the most serious complication is sepsis. When a pressure ulcer is present and there is aerobic or anaerobic bacteremia, or both, the pressure ulcer is most often the primary source of the infection. Additional complications of pressure ulcers include localized infection, cellulitis, and osteomyelitis. Quite often, a nonhealing pressure ulcer may indicate underlying osteomyelitis. Mortality can also be associated with pressure-ulcer development. Several studies have noted the association of pressure-ulcer development and mortality in both the hospital and nursing-home settings. In fact, the mortality rate has been noted to be as high as 60% for those older persons who develop a pressure ulcer within 1 year of hospital discharge. Thus, careful assessment of a pressure ulcer is essential. Finally, other complications of pressure ulcers include pain and depression. Both pain and depression have been associated with decreased wound healing.

RISK FACTORS AND RISK-ASSESSMENT SCALES

The literature abounds with lists of risk factors associated with pressure-ulcer development. However, any disease process that renders an elderly person immobile for an extended period of time will increase the risk for pressure-ulcer development. There are intrinsic factors and extrinsic factors that determine the tolerance of soft tissue to the adverse affects of pressure. Intrinsic risk factors are physiologic factors or disease states that increase the risk for pressure-ulcer development (eg, age, nutritional status, and decreased arteriolar blood pressure). Extrinsic factors are external factors that damage the skin (eg, friction and shear, moisture, and urinary or fecal incontinence, or both). Variables that appear to be predictors of pressure-ulcer development include age ≥ 70 years, impaired mobility, current smoking history, low body mass index, altered mental status (eg, confusion), urinary and fecal incontinence, malnutrition, restraints, malignancy, diabetes mellitus, stroke, pneumonia, congestive heart failure, fever, sepsis, hypotension, renal failure, dry and scaly skin, history of pressure ulcers, anemia, lymphopenia, and hypoalbuminemia.

Because of the myriad of risk factors associated with pressure-ulcer development, various scales have been developed to quantify a person's risk by identifying the presence of factors in several categories. The Braden Scale (see the [Appendix](#)) and the Norton Scale are probably the most widely used tools for identifying elderly patients who are at risk for developing pressure ulcers. Both tools are recommended by the Agency of Health Care Policy and Research (AHCPR, renamed the Agency for Healthcare Research and Quality). The Braden Scale has a sensitivity of 83% to 100% and a specificity of 64% to 77%; the Norton Scale has a sensitivity of 73% to 92% and a specificity of 61% to 94%.

The Guidelines recommend that bed- and chairbound patients or those with impaired ability to be repositioned should be assessed upon admission to the hospital or the nursing home for additional factors that increase the risk for developing pressure ulcers. A systematic risk assessment can be accomplished by use of a validated risk-assessment tool, such as the Braden Scale or the Norton Scale. Pressure-ulcer risk should also be reassessed at periodic intervals and when there is a change in level of activity or mobility. Studies have demonstrated that the incorporation of systematic risk-assessment tools has significantly reduced the incidence of pressure ulcers. To date, the Braden Scale is the only tool to be validated in nonwhite populations. It is important to note that the use of risk-assessment tools will not guarantee that all elderly persons at risk for pressure ulcers will be identified.

PREVENTION

The AHCPR sponsored the development of recommendations for the prevention of pressure ulcers in adults. These clinical practice guidelines (*Pressure Ulcers in Adults: Prediction and Prevention*, published in May 1992) provide an excellent approach to evidenced-based pressure-ulcer prevention.

Skin Care

There is limited evidence on skin care to prevent pressure ulcers. Most recommendations are based on expert opinions. The goal of skin care after identifying the older person at risk for pressure ulcers is to maintain and improve tissue tolerance to pressure in order to prevent injury.

All older persons at risk should have a systematic skin inspection at least once a day, with emphasis on the bony prominences. The skin should be cleansed with warm water and a mild cleansing agent to minimize irritation and dryness of the skin. Every effort should be made to minimize environmental factors leading to skin drying, such as low humidity (less than 40%) and exposure to cold. Decreased skin hydration has been found to result in decreased pliability, and severely dry skin has been noted to damage the stratum corneum. Dry skin should be managed with moisturizers.

Massaging over bony prominences should be avoided. Previously, it was believed that massaging the bony prominences promoted circulation. However, postmortem biopsies found degenerated tissue in those areas exposed to massage but no degenerated tissue on those areas that were not massaged. All efforts to avoid exposing the skin to urine and fecal matter resulting from incontinence, to perspiration, and to wound drainage should be undertaken. When disposable briefs are used to manage incontinence, the patient must be checked and changed frequently, since perineal dermatitis can develop quickly. The use of disposable underpads to control excessive moisture and perspiration may help wick moisture away from skin. The use of moisturizers and moisture barriers should also be considered to protect the skin.

Minimizing friction and shear is also important. This can be accomplished through proper repositioning, transferring, and turning techniques. The use of lubricants (eg, cornstarch and creams), protective films (eg, transparent film dressings and skin sealants), protective dressings (eg, hydrocolloids), and protective padding may be used to reduce the possibility of friction and shear. Malnutrition should be anticipated and treated promptly. Maintaining or improving mobility is also important. There are benefits of both active and passive range-of-motion exercises to decrease pressure on bony prominences.

Mechanical Loading

Older persons who are at risk for developing pressure ulcers should be repositioned at least every 2 hours. Bed-positioning devices such as pillows or foam wedges should be used to keep bony prominences from direct contact with one another. The head of the bed should be at the lowest degree of elevation consistent with medical conditions. The use of lifting devices, such as trapezes or bed linen, to move the person in bed will also decrease the potential for friction and shear forces. The heel is quite vulnerable to pressure-ulcer development. Studies suggest that approximately 20% of all pressure-ulcer development occurs at the heels. This may be attributed to the limited amount of soft tissue over the heel. Specific clinical interventions to prevent heel pressure ulcers have been developed (see [Table 30.1](#)).

Patients seated in a chair should be assessed for good postural alignment, distribution of weight, and balance. They should be taught or reminded to shift weight every 15 minutes. The use of doughnuts as seating cushions are contraindicated since they may cause pressure ulcers.

Support Surfaces

Any elderly person identified as being at risk for developing pressure ulcers should be placed on a pressure-reducing device. Two types exist: static (foam, static air, gel or water, or combination) or dynamic (alternating air, low air loss, or air fluidized). Most static devices are less expensive than dynamic surfaces. [Table 30.2](#) provides details about the various types of support surfaces that can guide selection for particular situations. Most experts would agree that for pressure-ulcer prevention, the use of static devices is appropriate. Two conditions warrant consideration of a dynamic surface:

- bottoming out occurs (the static surface is compressed to less than 1 inch), and
- the patient is at high risk for pressure ulcers and reactive hyperemia is noted on a bony prominence despite the use of a static support surface.

Although effective at reducing pressure, dynamic airflow beds have several potential adverse effects, including dehydration, sensory deprivation, loss of muscle strength, and difficulty with mobilization.

MANAGEMENT

The AHCPR developed evidence-based guidelines on the management of pressure ulcers. This guideline, *Treatment of Pressure Ulcers*, published in December 1994, reviews the foundation for providing evidence-based pressure-ulcer management.

General Assessment

The pressure ulcer will not heal unless the underlying causes are effectively managed. A general assessment should include identifying and effectively managing the medical diseases, health problems (eg, urinary incontinence), nutritional status, pain level, and psychosocial health issues that may have placed the elderly person at risk for pressure-ulcer development. Unless these areas are effectively addressed, the probability that the pressure ulcers will heal is low.

Ulcer Assessment

When a pressure ulcer has developed, a comprehensive evaluation is necessary. [Table 30.3](#) presents a systematic approach to assessment and documentation when a pressure ulcer develops.

There is no universal agreement on a single system for classifying pressure ulcers. Most experts do agree that the stage of an ulcer determines the appropriate treatment plan. It should be noted that staging alone does not determine the seriousness of the ulcer. Most systems use four stages to classify ulceration. [Table 30.4](#) describes one staging system. When eschar, a thick brown or black devitalized tissue, is covering the ulcer, the ulcer cannot be accurately staged.

The challenge for most staging systems occurs in the definition of the stage I pressure ulcer. There is more variability in attempts to classify the first stage of ulcer development than in any other stage. Most systems define the stage I pressure ulcer as nonblanchable erythema of intact skin; both the AHCPR prediction and prevention guidelines and the HCFA Minimum Data Set (required for all patients in long-term-care facilities) refer to stage I pressure ulcer in these terms. However, it is difficult (at best) to blanch the skin of persons with darkly pigmented skin. To address this concern, the National Pressure Ulcer Advisory Panel (NPUAP) revised its definition of a stage I pressure ulcer to encompass the skin alterations that might be seen in stage I pressure ulcers regardless of skin pigmentation. This system defines a stage I ulcer as an observable pressure-related alteration of intact skin whose indicators, as compared with an adjacent or opposite area on the body, may include changes in one or more of the following: skin temperature (warmth or coolness), tissue consistency (firm or boggy feel), or sensation (pain, itching). The NPUAP definition further states that the pressure ulcer appears as a defined area of persistent redness in lightly pigmented skin, whereas in darker skin tones, the pressure ulcer may appear with persistent erythema, or blue or purple hues. Although this definition is cumbersome, it is the only definition that includes patients with darkly pigmented skin.

Monitoring Healing

Monitoring the healing of pressure ulcers can pose a challenge to the practitioner. The accurate measurements of a pressure ulcer can inform the practitioner about the effectiveness of ulcer treatment. However, the use of traditional measurements (rulers and tracing paper) produces highly variable results among raters. In the past 8 years, two instruments to measure healing of pressure ulcers with some level of validity and reliability have been developed. The Pressure Sore Status Tool and the Pressure Ulcer Scale for Healing (PUSH; see the [Appendix](#)) are excellent tools for monitoring pressure-ulcer healing. The use of high-frequency portable ultrasound to measure wound healing has been introduced. The use of this technology, which can capture three-dimensional measurements, has been shown to be quite beneficial in objectively monitoring healing. Moreover, because ultrasound is “color blind,” it can detect stage I pressure ulcers in darkly pigmented skin.

There has been considerable debate regarding the use of reverse staging of pressure ulcers to monitor healing. Staging of pressure ulcers is appropriate only for defining the maximum anatomic depth of tissue damage. Since pressure ulcers heal to a progressively more shallow depth, they do not replace lost muscle, subcutaneous fat, or dermis before they re-epithelialize. Instead, pressure ulcers are filled with granulation (scar) tissue composed primarily of endothelial cells, fibroblasts, collagen, and extracellular matrix. A stage IV pressure ulcer cannot become a stage III, stage II, and then stage I; reverse staging does not accurately characterize what is physiologically occurring as the pressure ulcer heals. When a stage IV pressure ulcer has healed, it should be classified as a healed stage IV pressure ulcer, not a stage 0. The progress of healing can be documented only by describing ulcer characteristics or measuring wound characteristics with a validated tool.

Control of Infections

All pressure ulcers will become colonized with both aerobic and anaerobic bacteria, and superficial, swab cultures of the wounds have not been shown to be helpful in management. Wound cleansing and dressing changes are two of the most important methods for minimizing the amount of bacterial colonization. Increasing the frequency of wound cleansing and dressing changes is an important first step when purulent or foul-smelling drainage is observed on the ulcer. When ulcers are not healing or have persistent exudate after 2 weeks of optimal cleansing and dressing changes, it is reasonable to consider a 2-week trial of topical antibiotics (eg, silver sulfadiazine, triple antibiotic), monitoring carefully for allergic reactions. The use of topical antiseptics (eg, povidone iodine, iodophor, sodium hypochlorite, hydrogen peroxide, and acetic acid) is not recommended because of their tissue toxicity.

When ulcers fail to heal despite these treatments, it is reasonable to consider the possibility of cellulitis or osteomyelitis. Biopsy of the ulcer for quantitative bacterial cultures or of the underlying bone can be used to establish these diagnoses. The presence of cellulitis, osteomyelitis, bacteremia and sepsis are all indications for the use of systemic antibiotics.

Ulcer Care

Ulcer care should be evaluated for healing progress on a weekly basis. There are no standard healing rates for pressure ulcers. Review of the literature suggests that a majority of stage I pressure ulcers heal within 1 day to 1 week; stage II, within 5 days to 3 months; stage III, within 1 month to 6 months; and stage IV, within 6 months to 1 year. Clearly, some full-thickness pressure ulcers may never heal, depending on comorbidity; however, no clear guidelines exist to determine when a pressure ulcer can be truly defined as recalcitrant nor what characteristics must be present to predict that an ulcer will never heal.

Debridement

The presence of necrotic, devitalized tissue supports the growth of pathologic organisms and prevents healing. Because devitalized tissue is avascular, the use of topical antibiotics is not recommended. There are four types of debridement methods: mechanical, enzymatic, autolytic, and sharp ([Table 30.5](#)). The debridement method should be selected on the basis of the patient's health condition, the ulcer presentation, the presence or absence of infection, and the patient's ability to tolerate the procedure.

Dressings

Numerous dressings are used in the healing of pressure ulcers. The use of gauze wet-to-dry has been discouraged by experts, since this technique can damage the tissue matrix and prolong healing. Many experts advocate the use of hydrocolloid dressings. These dressings, when compared with gauze, have been found to significantly speed the healing process. This is most likely because hydrocolloids require fewer dressing changes (inflicting less trauma), block bacteria from penetrating the wound bed, and maintain a moist wound environment (facilitating increases in the growth factors needed in the healing process). It is essential to select an appropriate dressing, not on the basis of the stage of the pressure ulcer, but rather on the amount of wound exudate maximizing the moist wound environment. [Table 30.6](#) identifies some of the most common dressings and the indications for their use.

Nutrition

An association has been observed between pressure ulcers and malnutrition, and several studies have identified malnutrition as a risk factor for pressure-ulcer formation. Ensuring an adequate diet to prevent malnutrition, to the extent compatible with an individual's wishes, is a reasonable strategy to reduce the risk of ulcer formation. If a patient with a pressure ulcer is malnourished, the importance of diet and dietary supplements is more controversial. The AHCPR guideline rates the strength of the evidence as "C," the weakest rating, for nutritional support that achieves approximately 30 to 35 calories/kg/day and 1.25 to 1.50 g of protein/kg/day. Evidence to support the use of supplemental vitamins and minerals is equally weak.

Adjunctive Therapy

Throughout the years a myriad of treatments have been advocated for the healing of pressure ulcers without sufficient data to support their various claims. Data on the therapeutic efficacy of hyperbaric oxygen, low-energy laser irradiation, and therapeutic ultrasound have not been established. However, areas of great promise include the use of recombinant platelet-derived growth factors to stimulate healing and skin equivalents that may prove to heal stage III and stage IV pressure ulcers. Preliminary data on the uses of electrical stimulation, vacuum-assisted closures, and warm-up therapy, which increases the basal temperature of the ulcer to promote healing, are promising.

Surgical Repair

The use of surgical repair of a pressure ulcer remains a viable option for stage III and stage IV pressure ulcers. However, since many stage III and stage IV pressure ulcers eventually heal over a long period of time with the use of modern wound-healing principles, and since the rate of recurrence of surgically closed pressure ulcers is high, the practitioner must carefully weigh the benefits of the surgery. When the surgical option is exercised, the most common type of surgical repairs include direct closure, skin grafting, skin flaps, musculocutaneous flaps, and free flaps.

ANNOTATED REFERENCES

- Allman RM, Goode PS, Patrick MM, et al. Pressure ulcer risk factors among hospitalized patients with activity limitation. *JAMA* 1995;273(11):865–870.

This prospective inception cohort study examined demographic, medical, functional status, and nutritional characteristics that predicted stage II or greater pressure ulcers in a cohort of bed- or chairbound patients. The main outcome measure was time to in-hospital pressure-ulcer development of a stage II or greater pressure ulcer. The study found that the total cumulative incidence of pressure ulcers was 12.9%, with a median time of 9 days. This study also found that nonblanchable erythema, lymphopenia, immobility, dry skin, and decreased weight were all independent and significant risk factors for pressure-ulcer development in hospitals.

- Beitz JM, van Rijswijk L. Using wound care algorithms: a content validation study. *JWOCN*. 1999;26(5):236–249.

The use of algorithms to direct ulcer care is increasing. However, most algorithms lack validity. Using a cross-sectional study design, the authors used 44 experts in wound care to validate a comprehensive wound-care algorithm. The algorithm had a content validity of 0.86, and the individual content validity index of 34 of 44 experts was > 0.8. The algorithm content was demonstrated to be valid.
- Bergstrom N, Bennett MA, Carlson CE, et al. *Treatment of Pressure Ulcers. Clinical Practice Guidelines No. 15*. Rockville, MD: US Department of Health and Human Services, Public Health Service, Agency for Health Care Policy and Research. December 1994. AHCPR Pub. No. 95-0652.

This is a comprehensive guideline to the assessment and management of pressure ulcers. As in other guidelines from this agency, the strength of the evidence supporting recommendations is provided. There are many useful algorithms, validated assessment tools, practical treatment approaches, and a helpful glossary. A synopsis of the main points is available in *Quick Reference Guide for Clinicians*.
- Berlowitz DR, Bezerra HQ, Brandeis GH, et al. Are we improving the quality of nursing home care: the case of pressure ulcers. *J Am Geriatr Soc*. 2000;48(1):59–62.

This is a retrospective study using the Minimum Data Set to examine the National Health Care Corporation nursing homes from 1991 through 1995. Risk-adjusted rates of pressure-ulcer development that were based on 144,379 observations from 30,150 residents in 107 nursing homes were determined. The study found that between 1991 and 1995, there was a significant ($P < .05$) decrease of 25% in pressure-ulcer development. Moreover, the rate of stage III and stage IV pressure ulcers significantly decreased, from 30% to 2.2% ($P < .01$).
- Lyder CH, Yu C, Emerling J, et al. The Braden Scale for pressure ulcer risk: evaluating the predictive validity in black and Latino/Hispanic elders. *Applied Nurs Res*. 1999;12(2):60–68.

This prospective study of 74 hospitalized black American and Hispanic American elderly patients at risk for pressure-ulcer development were used to determine the predictive validity of the Braden Scale. The study found for blacks a sensitivity of 81%, specificity of 100%, a positive predictive value of 100%, and a negative predictive value of 60%. For Hispanics, the study found a sensitivity of 90%, specificity of 14%, a positive predictive value of 60%, and negative predictive value of 50%. The study concluded that the Braden Scale was appropriate to use in both minority elderly populations.

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