Management of Pressure Ulcers

Review Article [1] | November 01, 2001 | Palliative and Supportive Care [2], Oncology Journal [3]
By Paul Walker, MD [4]

Pressure ulcers are a common problem, with about 1.5 to 3 million individuals in the United States affected. Treatment may be costly, requiring lengthy periods of hospitalization. Central to the development of pressure cancer can be a devastating illness causing severe debilitation and prolonged confinement to bed. It is, therefore, not unexpected that oncologists would be required to manage pressure ulcers as part of the comprehensive care of their cancer patients. The consequences of these lesions can be devastating, even fatal. Thus, the common bedsore should not be overlooked as an important clinical problem.

Other names assigned to these lesions include decubitus ulcer, skin breakdown, and pressure sore. Recent literature uses the term "pressure ulcer," which clearly indicates the etiology of the lesion. The Agency for Health Care Research and Quality (formerly, the Agency for Healthcare Policy and Research) conducted the most recent comprehensive review of the topic.[1] It defines a pressure ulcer as "any lesion caused by unrelieved pressure resulting in damage of underlying tissue." This usually occurs when tissue is compressed between a bony prominence and an external surface resulting in tissue necrosis.

Assistance with management may be obtained by consulting with colleagues knowledgeable in the field. But finding such physicians may be challenging because interest in this topic is underrepresented and spread across many disciplines, such as rehabilitation medicine, plastic surgery, critical care, family medicine, geriatrics, and palliative care. The field of nursing, however, has been very active in this area of research, and nurse specialists such as enterostomal therapists, who frequently are exposed to these problems, may be better able to provide assistance. Health-care workers in the fields of physiotherapy, occupational therapy, and nutrition science may also be helpful in developing a management plan.

Epidemiology

An estimated 1.5 to 3 million people in the United States suffer from pressure ulcers.[2] Approximately 100,000 of these people are nursing home residents.[3] Among these residents, incidence studies have shown that the longer the patient stays in the nursing home, the greater the likelihood of ulcer development.[4] One study indicated that 13.2% of residents developed an ulcer within 1 year and 21.6% developed an ulcer within 2 years.[3] Prevalence rates in long-term care facilities ranged from 2.4%[5] to 23%.[2,6] Statistics from acute-care facilities are remarkably similar, with incidence rates ranging from 2.7%[7] to 29.5%[8] and prevalence rates from 3.5%[9] to 29.5%.[10]

Individuals at particularly high risk of developing these lesions include elderly patients with femoral fractures (66% incidence)[11] and hospitalized quadriplegic patients (60% prevalence).[12] Among patients in the intensive care units, incidence rates average 33%.[13] and prevalence rates, 21%.[14] The majority of all pressure ulcers (50% to 70%) develop in patients older than age 70 years, thus highlighting the importance of age as a risk factor.[15]

Terminally ill cancer patients are also known to be at risk for this problem. A report from St. Christopher's Hospice revealed a prevalence of 19% among 7,000 terminally ill patients.[16] Kaasa et al[17] found a higher incidence (33%) on reviewing consecutive patients in a palliative care unit. However, this rate was reduced to 7% after an interdisciplinary wound management committee was created.
Pressure ulcers may lead to lengthy periods of hospitalization.[18] Estimates of the total costs associated with treatment vary greatly. Within the United States, published estimates have ranged from $1.3 billion[19] to an excess of $5 billion[20-22] annually.

Etiology

Central to the development of pressure ulcers is the loss of an essential protective mechanism—that of spontaneous movement. Everyday life requires that we alter our position, shifting our weight while standing or sitting or adjusting our position while lying down, to alleviate the effects of pressure. This occurs consciously and subconsciously in response to the noxious stimulus of unrelieved pressure. (Think of how you squirm in your seat during a long lecture.) When this protective mechanism is impaired through neurologic injury or debility, the damage caused by unrelieved pressure becomes evident.[23] Factors such as pain, spinal cord compression, brain metastases, massive ascites or edema, pathologic fractures, asthenia, and coma may impair this protective mechanism in cancer patients.

The Development of Necrosis

Tissue that becomes trapped between the support surface and a bony prominence may sustain pressure that exceeds normal capillary filling pressure. Once this happens, capillary collapse occurs with the cessation of perfusion.[18,23-25] Normal tissue can tolerate this condition for brief periods, but ischemic damage occurs if pressure is not soon relieved. This process involves tissue hypoxia, acidosis, vessel leakage, hemorrhage, and accumulation of toxic cellular waste.[26] The resulting tissue necrosis can become the focus of a further complicating process, infection. It is often not appreciated that pressure within the tissue is greatest closest to the bony prominence, and this is where necrosis begins. The tissue damage, therefore, occurs first deep in muscle and subcutaneous tissue and then extends outward to the skin, resulting in a cone of tissue destruction that is largest adjacent to the bone (Figure 1).[23,24]

The recently employed term, "skin breakdown," is therefore a misnomer because it may imply that the damage begins at the skin. In reality, skin damage is only the tip of the iceberg,[24] indicating a much larger area of tissue necrosis with extensive undermining below what appear to be normal skin margins. Lesions of this type occur predominantly in the pelvic region related to the bony prominence of the sacrum (23% of ulcers), ischium (24% of ulcers), and greater trochanters (15% of ulcers).[23] Other areas that should be observed for the development of pressure ulcers include the heels, malleoli, fibular heads, knees, elbows, spinous processes, and scapulae.

Extrinsic and Intrinsic Factors

Extrinsic factors that may predispose tissue to injury include friction, maceration, and shear.[2,15] Friction may occur when the patient is accidentally dragged across the bedsheets while being positioned. Shearing occurs by elevating the head of the bed, thus causing the patient to slide downward while the surface of the skin remains in a relatively fixed position.[25] This deforms the vessels in the tissue and impedes profusion. Maceration caused by profuse sweating or urinary and fecal incontinence weakens the skin’s surface. Although these extrinsic factors may occur, it is important to note that unrelieved pressure is the prime contributing factor in the development of significant pressure ulcers.[1,23,24,26]

There are also intrinsic factors that increase the patient’s risk of developing pressure ulcers. These most importantly include conditions that limit spontaneous movement, as previously mentioned, and medical conditions that reduce tissue oxygenation such as peripheral vascular disease, diabetes, anemia, smoking, and dehydration. With age, the skin becomes more susceptible to damage and has a decreased rate of healing. The skin of the elderly has fewer elastic fibers and dermal blood vessels, and a reduced epidermal proliferation rate.[2,27] Poor nutrition is a known intrinsic factor in the development of pressure ulcers.[21,28,29]

Diagnosis of a pressure ulcer is usually uncomplicated. The ulcer develops in a patient who has suffered some loss of the protective mechanism of spontaneous movement and is usually situated
over a dependent bony prominence. Differential diagnoses that should be considered include venous, arterial, neuropathic, and neoplastic ulcers as well as radiation injury.

**Prevention**

Preventing the formation of pressure ulcers in patients at high risk is an important objective. Risk assessment tools have been developed in an attempt to identify vulnerable patients who may then undergo preventative interventions. Many such tools exist. Two of the best known tools are the Norton[30] and Braden scales.[31,33] The Braden scale, evaluates the domains of sensory perception, moisture, activity, mobility, nutrition, and friction/shear. The total score obtained indicates the patient’s susceptibility. Advanced cancer patients almost always score in the high-risk range. These tools, therefore, may be used more appropriately earlier in the course of cancer treatment and may have limited utility in the assessment of patients in palliative care units or hospices. In addition, recent studies have suggested that risk assessment tools may have significant limitations. Predicting the formation of pressure ulcers has been found to be a complex process, and instituting preventative measures does not always avoid ulcer formation in all patients.[33-36]

Current recommendations advise providing optimal skin care to those at risk of tissue breakdown. Harsh chemicals, skin trauma, and excessive drying should be avoided when the skin is cleaned. In incontinent patients, the use of absorbent garments may prevent maceration. Protective dressings and ointments, such as petroleum jelly, that can be placed on normal skin as a moisture barrier are helpful. Maneuvers that reduce the patient’s exposure to friction, such as the use of a lift sheet or trapeze, are advisable. The time-honored nursing practice of turning or repositioning the patient usually at 2-hour intervals is helpful because it allows different skin surfaces to bear the brunt of the body’s pressure, much as the process of normal spontaneous movement would.[1,37] However, in terminally ill patients, pain and other symptoms may not make this advisable.

**Pressure-Reducing Support Surfaces**

Several types of pressure-reducing support surfaces are currently on the market. Table 1 lists the main categories of these beds and mattresses. One of these surfaces should be considered for any patient at risk of developing pressure ulcers. Issues that may become important in the selection of a support surface include availability, costs, noise level, and maintenance. The characteristics of the surface may be designed to solve individual problems of moisture retention, heat accumulation, or shear forces (Table 2).

Practices that may be harmful include the use of doughnut or ring-type devices. These are contraindicated because they impair circulation and produce new pressure points as well as venous congestion and edema.[1,38] Elevating the head of the bed encourages the development of friction and shear forces. This should be discussed with the patient, with the goal of keeping it at the lowest level of elevation consistent with good care and raising the head of the bed only for short periods such as meal times.[1,39] It is also recommended that the patient not be placed in the lateral decubitus position with the greater trochanters bearing weight.[37,40,41] Confusion exists over the role of massage. Preliminary evidence suggests that massage may cause deep-tissue trauma, and no evidence exists to suggest that it encourages blood flow.[42,43] Massage, therefore, should not be directed over the bony prominences.[37]

**Staging**

Pressure ulcers are clinically staged from stage I to stage IV according to the severity of the lesion, ie, the level of tissue destruction. It is important to remember, however, that ischemia and tissue necrosis occur from the inside out, as previously described. The outside-looking-in approach for staging these lesions must be used cautiously, because it has the potential to confuse caregivers about the mechanism and extent of injury and could lead to inadequate management.

- **Stage I**—Consists of nonblanchable erythema of intact skin, the heralding lesion of skin ulceration.
Management of Pressure Ulcers
Published on Cancer Network (http://www.cancernetwork.com)

- **Stage II** - Characterized by partial-thickness skin loss involving epidermis, dermis, or both. The ulcer is superficial and presents as an abrasion, shallow crater, or blister.

- **Stage III** - Characterized by full-thickness skin loss, involving damage to or necrosis of subcutaneous tissue that may extend down to, but not through, the underlying fascia. The ulcer presents clinically as a deep crater, with or without undermining of adjacent tissue.

- **Stage IV** - Full-thickness skin loss occurs, with extensive destruction, tissue necrosis, or damage to muscle, bone, or supporting structures (e.g., tendon, joint capsule). Undermining and sinus tracts also may be associated with stage IV pressure ulcers.

It is important to remember that it is not possible to stage a pressure ulcer until the eschar has been removed.[1] Also, in darkly pigmented individuals, diagnosing stage I pressure ulcers may be difficult.[1]

As part of the comprehensive assessment of the patient, a complete history, physical examination, and list of the clinical problems should be completed along with staging of the pressure ulcer. Assessment of the nutritional status as well as psychosocial issues such as the patient’s comprehension of the problem, motivation, plans, and needs should be explored.

**Treatment**

Once a pressure ulcer has been diagnosed, staging of the ulcer and a comprehensive assessment is required. A treatment plan may then be devised. Skin or wound care teams can provide important input in this planning phase and can educate patients, families, and caregivers. Planning should include management of tissue loads, ulcer care, and nutritional support (Figure 2).

**Management of Tissue Loads**

Complete relief of pressure over the injured area is important in healing pressure ulcers.[1,2,15] In severely symptomatic cancer patients, this may not be possible; rather, attention to repositioning the patient may be more practical. Small frequent adjustments of the patient’s position can be made using pillows or foam wedges.[1] Pressure reducing support surfaces (Table 1) may also be of benefit. These mattresses and beds employ a common principle of increasing the surface area of weight dispersion. Deciding when to use a particular support surface may be aided by consulting a treatment algorithm (Figure 3).

**Ulcer Care**

Local care for the ulcer consists of debridement of necrotic tissue, keeping the wound clean, placement of appropriate dressings, and consideration of adjunctive therapies. Debridement of the wound is an essential and often underutilized treatment (Figure 4). It improves wound healing and reduces the risk of infection. Four methods are available, ranging from the most aggressive to the least aggressive[1]:

1. **Sharp or surgical debridement**: This is the most rapid method and is recommended especially if infection is present or there are large necrotic areas or thick eschar.

2. **Mechanical debridement**: This includes wound irrigation, hydrotherapy, dextranomers, and the older technique of wet-to-dry dressing changes. To supply the correct pressure for ulcer irrigation, a 35-mL syringe may be used with a 19-gauge needle or angiocatheter to inject...
irrigating fluid on the ulcer. This produces approximately 8-psi pressure to effectively remove necrotic tissue without driving bacteria into the wound.

3. Enzymatic debridement: Collagenase or other enzymes are used in this method, which is slower, but may be indicated if sharp debridement is not tolerated, and the ulcer is not infected.

4. Autolytic debridement: Enzymes normally present in the wound fluid digest necrotic tissue. This is not recommended for infected ulcers because it is an especially slow process.

Once the ulcer is debrided, routine wound cleansing is required at each dressing change. Saline is the recommended solution because other cleansers and antiseptics have shown various degrees of toxicity to leukocytes and fibroblasts.[44-50] Iodine and hydrogen peroxide are not recommended for wound irrigation. Use of a device that delivers 8 psi of pressure, such as a 19-gauge angiocatheter with a 35-mL syringe, is appropriate. Ulcers with thick slough or persisting necrotic tissue may benefit from whirlpool treatments.

Wound dressings are used to keep the ulcer tissue moist and the surrounding intact skin dry.[51-55] Maintaining a moist wound environment is important because it promotes the migration of fibroblasts and epithelial cells and preserves the presence of many growth factors within the wound exudate that speed healing.[57] A large assortment of dressings is available, and in five controlled trials that compared various types of moist wound dressings, no difference was observed in how the pressure ulcers healed.[57-61]

Moist saline gauze dressings are inexpensive but must be changed more frequently to keep them from drying out. More expensive dressings such as hydrocolloids, foams, hydrogels, and alginates may require less frequent dressing changes. Semipermeable film dressings may be appropriate for stage I or small stage II ulcers.[2] Consulting an experienced enterostomal therapy nurse may assist in determining the optimal dressing for a particular ulcer.

Many adjunctive therapies are available. The greatest amount of clinical evidence has been documented for electrotherapy, which is used to enhance ulcer healing.[62-68] It is recommended for stage III/IV pressure ulcers that have not responded to conventional therapy and for refractory stage II ulcers.[1] At present, this appears to be an evidence-based treatment that may be underutilized. It is well tolerated, and in one study, only 15% of patients reported tingling sensations.

A large number of growth factors are known to exist within the ulcer milieu. Use of growth factors to accelerate wound healing, however, has produced somewhat disappointing results.[69] Recombinant human platelet-derived growth factor, becaplermin (Regranex), available as a topical gel formulation, was approved by the Food and Drug Administration for the treatment of diabetic neuropathic ulcers. Earlier studies of this agent in the treatment of pressure ulcers were not impressive.[70] However, in a recent controlled trial, complete healing was significantly better in the group treated daily with 100 or 300 µg/g of becaplermin gel compared with placebo.[71]

Vacuum-assisted closure is a recent development in which polyvinyl foam is inserted into the wound and a negative pressure of 125 mm Hg is applied. This is believed to decrease the wound dimension and chronic edema, and exudate and increase blood flow and the formation of granulation tissue.[72] Anecdotal reports and published case series[73-76] support this technique; however, it has not been fully evaluated in controlled clinical trials.[69] Treatment with low-energy laser, ultrasound, infrared, or ultraviolet is not recommended because of the lack of controlled clinical trials relating to pressure ulcers.[1]

Managing Infection

Because pressure ulcers become colonized by bacteria, swabbing these areas for bacterial culture is not helpful in determining the presence of infection. In ulcers that exhibit a purulent discharge, foul
odor, or periulcer inflammation, a clinical diagnosis of infection may be made. The Centers for Disease Control and Prevention (CDC) recommends obtaining a meaningful culture by injecting sterile fluid subcutaneously at the margin of the ulcer, followed by aspiration.[77] The algorithm in Figure 5 may assist in directing management of infected pressure ulcers.[1]

Local ulcer infections are usually polymicrobial with gram-positive, gram-negative, and anaerobic organisms. Two studies support the use of broad-spectrum topical antibiotics such as silver sulfadiazine for the treatment of these infections.[78,79] For the more serious situation of advancing infection, such as spreading cellulitis, bacteremia, or osteomyelitis, systemic antibiotics are recommended. The usual organisms found in this situation are *Staphylococcus aureus*, gram-negative bacilli, and *Bacteroides fragilis*.

Mortality among patients with bacteremia has been reported to approach 50% or more.[80,81] It is important that empiric systemic antibiotic coverage be administered until blood or tissue cultures are available to guide therapy further.[80-83] The possibility of osteomyelitis must be kept in mind because it is particularly difficult to diagnose, and its incidence has been associated with 26% of nonhealing pressure ulcers.[84]

**Surgical Repair**

Advanced cancer patients frequently are nutritionally compromised and debilitated secondary to their disease. Surgery is rarely recommended in this setting. Earlier in the management of cancer, surgery may be a more viable option. Musculocutaneous flaps have been considered the surgical treatment of choice for paraplegic patients because they can improve blood flow and provide a barrier to infection as well as aid in the treatment of osteomyelitis.[85-87] Noninfected stage III and IV ulcers that are not improving with optimal therapy would be considered appropriate for surgical repair.[1] Alternative procedures include direct closure, skin grafting, and skin flaps. Patients must be carefully selected because the surgical procedure can result in extensive blood loss and prolonged anesthesia.[1] These patients should be medically stable and have good nutritional status, the expectation of a good rehabilitative outcome, and lowered risk for ulcer recurrence.

**Nutrition**

Poor nutrition is a known risk factor for pressure ulcers; the severity of the malnutrition correlates with the stage of the pressure ulcer.[21,28,88-93] In advanced cancer patients, nutritional issues become complicated; the anorexia-cachexia syndrome is a complication in 85% of cancer patients.[94] The use of tube feeding or total parenteral nutrition offers little benefit. In controlled clinical studies, total parenteral nutrition did not improve survival or response to antineoplastic treatment, or decrease the toxicity of treatment.[94] Whether surgical complications are decreased by total parenteral nutrition remains controversial,[95] and data are lacking on whether quality of life is improved.[94]

Two agents have proven to be somewhat helpful in the anorexia-cachexia syndrome. Megestrol acetate (Megace) has been shown to increase appetite and induce weight gain through fat deposition.[96-98] Dronabinol (Marinol) has also been shown to induce some weight gain and appetite stimulation. It is unclear, however, whether the use of these agents improves the nutritional status of cachectic patients enough to enhance pressure ulcer healing. The effect of agents currently under investigation such as thalidomide (Thalomid) and omega-3 fatty acids would be interesting to consider should they demonstrate activity in this devastating syndrome of malnutrition.

Taylor et al, in a small controlled study,[99] found that patients who received 500 mg of vitamin C twice daily experienced improved healing of pressure ulcers. If the patient appears malnourished, and therefore at risk of vitamin and mineral deficiencies, high-potency vitamin and mineral supplements containing vitamin C and zinc should be administered.[99,100] The addition of an agent such as megestrol acetate to treat cachexia may also be considered.

**Conclusions**
In the management of pressure ulcers, we must remember the person with the ulcer. Patients should be consulted regarding their preferences, the expected benefits and burdens of treatment, and the likely outcomes. It must be acknowledged that vigorous treatment with repositioning, debridement, dressing changes, and nutritional interventions may not be well tolerated by individuals with advanced illness. Furthermore, they may receive limited benefit.\[37,101\]

At some point, treatment may no longer be directed at healing these lesions.\[101\] This is particularly pertinent for patients in the terminal phase of their illness. At this point, it may be more appropriate to provide comfort through the use of analgesics\[1\] and appropriate support surfaces and dressings.\[37,101\] If pressure ulcers are considered a quality-of-care issue, it is possible that patients may not be treated in the best or most humane fashion. The dogma that all pressure ulcers are caused by poor care should be recognized as incorrect. It is important to remember that even the most exemplary care may not prevent the development of, or heal existing, pressure ulcers in high-risk patients.\[37,101\]

**References:**


