Guidelines for the treatment of pressure ulcers

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Health care providers face the challenge of providing effective care for increasing numbers of patients with chronic wounds. Pressure ulcers, one type of chronic wound, are estimated to affect 1.3–3 million individuals in the United States.1 Prevalence varies among specific clinical populations, with higher percentages reported for the elderly, the acutely ill, and those who have sustained spinal cord injuries.2,3,4 The first comprehensive clinical practice guidelines for the treatment of patients with pressure ulcers were published by the Agency for Healthcare Research and Quality (AHRQ) in 1994. Since that time, a number of professional groups have also developed and published guidelines.

The acceptance and adoption of guideline recommendations in practice is variable and influenced by several factors, including (1) guideline currency with the most recent and comprehensive evidence, (2) recognition and acceptance of guideline validity, (3) breadth of interprofessional representation in guideline development, and (4) guideline presentation and format.5 These issues pertain to guidelines in general, but are also applicable to those specific to chronic wounds. Despite many recent advances in wound care, the challenge of managing chronic wounds remains compounded by the current lack of consensus on clearly defined, comprehensive wound care principles and uniformly accepted analytical methods to evaluate outcomes. With these concerns in mind, the following guidelines were developed to facilitate use by multiple groups in the wound care community of clinicians, researchers, industry, governing agencies, and third-party payers.

The guidelines provide recommendations for treatment of pressure ulcers supported by current evidence. However, treatment decisions also depend on specific patient characteristics, pressure ulcer characteristics/stage, patient circumstances, and overall goals. The development of a treatment plan of care begins with the determination of the goals of therapy. In most cases, the goal of therapy is to produce complete healing with restoration of functional skin integrity to the highest extent possible. However, in certain cases, the goal of therapy may not be complete healing of the wound. For example, in patients who are terminally ill, the goal of therapy may be palliative and focused on reducing discomfort or deterioration of the pressure ulcer, rather than complete healing of the wound. In other cases, the treatment may produce added discomfort or increased risk to the patient. Individual evaluation of each case is necessary within the context of the optimum outcome for that patient.

The specific objectives of this project were to:

2. Present these guidelines in a clear, simple format designed to enable health care providers to make informed, evidence-supported treatment decisions to manage pressure ulcers appropriately.

METHODS

A search of health care databases for current published evidence-based guidelines addressing the treatment of pressure ulcers was conducted between July 2004 and January 2006 using electronic and online resources. In addition to published guidelines, PubMed, EMBASE, and the Cochrane Database of Systematic Reviews were reviewed for evidence on pressure ulcer treatment. The following guidelines were located and reviewed by the panel and used in the development of the categories of treatment and individual guidelines.


The panel used a consensus process to determine the treatment categories. Subgroups of the panel (two to three individuals) were responsible for the development of specific guidelines and review of evidence within treatment categories. The first complete document was reviewed by the full panel and revised. The guidelines were presented for public comment in a forum hosted on the National Institutes of Health (NIH) campus (October 2005). Guidelines were further revised based on verbal and written comments received during the public forum review process. This revision was submitted to full panel review and additional modification before adoption. Additional revisions are based on review and critique provided by the board members of the Wound Healing Society and Wound Healing Foundation.

### Classification of Evidence

Our approach differed from the previous approaches used in evidence-based guidelines. In most published guidelines, evidence was based on clinical human studies. Laboratory or animal studies were not cited. Our approach was not limited to human clinical studies or to a specific study design (e.g., RCT). We have used well-controlled animal studies that present proof of principle, especially when a clinical series corroborated the laboratory results. It was also clear that principles that have been validated for other chronic wound types often are applicable to pressure ulcers. Therefore, evidence is included for some guidelines that were not specific for pressure ulcers. Because of these variations, a different system was necessary to grade the evidence weight supporting a given guideline. The strength of evidence supporting a guideline is listed as Level I, Level II, or Level III using the following definitions:

- **Level I**: Meta-analysis of multiple RCTs or at least two RCTs supporting the intervention in the guideline or multiple laboratory or animal experiments with at least two clinical series supporting the laboratory results.
- **Level II**: Less evidence than Level I, but at least one RCT and at least two significant clinical series or expert opinion papers with literature reviews supporting the intervention. Experimental evidence that is quite convincing but without support by adequate human experience is included.
- **Level III**: Suggestive data of proof of principle, but lacking sufficient data such as meta-analysis, RCT, or multiple clinical series.

### References

RESULTS

1. POSITIONING AND SUPPORT SURFACES

**Preamble:** Pressure and compression to soft tissue play a role in the etiology of pressure ulcers. Patient positioning and methods to reduce pressure-related tissue damage are recognized as important treatment components. While there are limited definitive studies, the best current evidence and expert opinion suggest the following guidelines.

**Guideline #1.1:** Establish a repositioning schedule and avoid positioning patients on a pressure ulcer. (Level II)

**Principle:** Pressure ulcers are thought to result from compression of soft tissues against a bony prominence. It is reasonable to assume that pressure on an ulcer can result in delayed healing. Patients should be repositioned to relieve pressure over bony prominences. The exact turning interval is not known and is derived empirically. Reductions in pressure incidence have been achieved, but positioning is not universally effective.

**Evidence:**

**Guideline #1.2:** Maintain the head of the bed at the lowest degree of elevation consistent with medical conditions and other restrictions. Limit the amount of time the head of the bed is elevated and elevate only when there is a compelling medical indication (e.g., 1–2 hours after tube feeding or with severe respiratory or cardiac compromise). (Level III)

**Principle:** Elevation of the head of the bed produces shear and friction forces between the skin and the bed surface. Friction and shear may predispose to the development of pressure ulcers.

**Evidence:**

**Guideline #1.3:** Assess all patients for risk of developing a pressure ulcer. Use a pressure-reducing surface in those patients at risk. A pressure-reducing surface is superior to a standard hospital mattress in reducing the incidence of pressure ulcers. (Level I)

**Principle:** When compared with a standard hospital mattress, a variety of pressure-reducing devices can lower the incidence of pressure ulcers by about 60 percent.

**Evidence:**

**Guideline #1.4:** A static support surface may be appropriate for patients with a pressure ulcer who can assume a variety of positions without placing pressure on the ulcer or “bottoming out.” No difference in pressure ulcers outcomes is documented among different types of static devices. (Level I)

**Principle:** Static pressure-reducing devices are superior to standard hospital mattresses. However, if the patient “bottoms out” (if there is less than one inch of material between the bed and the pressure ulcer when feeling under the support surface with the palm of your hand), the device may be ineffective.

**Evidence:**

**Guideline #1.5:** A dynamic support surface may be appropriate for patients with a pressure ulcer who cannot assume a variety of positions in bed, or who “bottom out” on a static surface, or whose ulcer is failing to progress toward healing. (Level I)

**Principle:** Although some patients improve on a static support surface, there is evidence that other patients have an improved outcome on a dynamic support surface. No difference among studied types of dynamic devices has been shown.

**Evidence:**

**Guideline #1.6:** In patients who have a large stage 3 or stage 4 pressure ulcer, or multiple pressure ulcers involving several turning surfaces, a low-air-loss or air-fluidized bed may be indicated. (Level I)

**Principle:** Several studies have shown improved outcomes for pressure ulcers in patients treated with a low-air-loss or air-fluidized bed. However, these studies have some limitations, including difficulty for patients in self-positioning or for patients with pulmonary compromise.

**Evidence:**
2. Cullum N, McInnes E, Bell-Syer SEM, Legood R. Support surfaces for pressure ulcer prevention. *The...
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Evidence:

Cochrane Database of Systematic Reviews 2004; 3. [STAT]


Guideline #1.7: A patient at risk for a pressure ulcer should avoid prolonged sitting. Postural alignment, distribution of weight, balance, stability, and pressure reduction should be considered in seated individuals. (Level III)

Principle: Tissue compression between the sitting surface and bony prominence should be relieved in at-risk patients. In patients with a pressure ulcer, sitting on the pressure ulcer should be avoided. Reposition the sitting individual to relieve pressure at least every hour. If this schedule cannot be maintained, return the patient to bed. Individuals should be instructed to shift their weight every 15 minutes.

Guideline #1.8: Use a seat cushion based on the needs of the individual who requires pressure reduction in the sitting position. Avoid using doughnut-type devices. (Level III)

Principle: Several seat cushions reduce pressure in sitting individuals. Examine seating cushions and devices for “bottoming out.” There is insufficient evidence on the value of seat cushions in the prevention of pressure ulcers. Ring cushions (doughnut) devices increase venous congestion and edema.

2. NUTRITION

Preamble: Protein, carbohydrates, vitamins, minerals, and trace elements are required for wound healing. Nutrition is valued and considered in practice as a significant factor in the prevention and treatment of pressure ulcers. However, there are limited definitive studies documenting the efficacy of nutritional treatments for pressure ulcer healing. The following guidelines reflect the best current evidence and expert opinion.

Guideline #2.1: Nutritional assessment should be performed on entry to a new healthcare setting and whenever there is a change in an individual’s condition that may increase the risk of undernutrition. (Level II)

Principle: Nutrition must be adequate to provide sufficient protein to support the growth of granulation tissue. The patient’s weight on entry to the healthcare system is a good starting point. Assess body weight whenever there is a change in an individual’s condition that may increase the risk of undernutrition. Achieving a weight as close to the ideal body weight as possible is the goal. Assessment of pre-albumin level (reflecting recent protein consumption) and serum albumin level (reflecting long-term protein consumption) is useful to identify patients who are outside the norm. Encourage nutritional support if an individual is undernourished. Undernutrition is associated with poor clinical outcomes, including increased risk of mortality, so early identification of actual or potential nutritional need allows for timely intervention to mitigate nutritional decline. No studies were identified that specifically address the issue of obesity and pressure ulcer development.


**Guideline #2.2:** Encourage dietary intake or supplementation if an individual who is undernourished is at risk of developing a pressure ulcer. (Level III)

**Principle:** Nutrients are basic to cellular integrity and data suggest that a nutritional supplement may have a modest effect in preventing the development of pressure ulcers, largely in stage 1 ulcers.

**Evidence:**

**Guideline #2.3:** Ensure adequate dietary intake to prevent undernutrition to the extent that this is compatible with the individual’s wishes. (Level III)

**Principle:** Adequate nutrition is essential for life and undernutrition is associated with the development of pressure ulcers. Nonetheless, the nutritional plan needs to be consistent with the individual’s personal goals.

**Evidence:**

**Guideline #2.4:** If dietary intake continues to be inadequate, impractical, or impossible, nutritional support (usually tube feeding) should be used to place the patient into positive nitrogen balance (approximately 30–35 calories/kg/day and 1.25–1.50 g of protein/kg/day) according to the goals of care. (Level III)

**Principle:** Anabolism is facilitated with a positive nitrogen balance and when individuals are not able to meet nutritional needs through oral intake, alternative methods should be undertaken to optimize nutritional status.

**Evidence:**

**Guideline #2.5:** Give vitamin and mineral supplements if deficiencies are confirmed or suspected. (Level III)

**Principle:** Supplements of vitamins and minerals that are needed for wound healing should be provided when intake is insufficient or when a deficit is identified. No acceleration in healing has been reported with supplemental Vitamin A, Vitamin C, or zinc. Amino acids supplements have been effective in the healing of some non-pressure-related wounds. Arginine has not been found to accelerate healing in patients with pressure ulcers.

**Evidence:**


8. Langkamp-Henken B, Herrlinger-Garcia KA, Stechmiller JK, Nickerson-Troy JA, Lewis B, Moffatt L. Arginine supplementation is well tolerated but does not enhance mitogen-induced lymphocyte proliferation in elderly nursing home residents with pressure ulcers. JPN 2000; 24: 280–7. [RCT]


3. INFECTION

Preamble: Infection results when the bacteria:host defense equilibrium is upset in favor of the bacteria. Infection plays various roles in the etiology, healing, operative repair, and complications of pressure ulcers. Therefore, guidelines are necessary to address the treatment of infection under each of these circumstances.

Guideline #3.1: Treat distant infections (e.g., urinary tract, cardiac valves, cranial sinuses) with appropriate antibiotics in pressure-ulcer-prone patients or patients with established ulcers. (Level II)

Principle: Bacteria entering the bloodstream or lymphatics can lodge in compressed tissue, denervated tissue, edematous tissue, or established wounds by the compromised tissue acting as a locus minoris resistentiae.

Evidence:


5. Richardson D. Diagnosis and management of systemic infections and fever in neurological patients. Semin Neurol 2000; 20: 387–91. [LIT REV]


Guideline #3.2: Remove all necrotic or devitalized tissue by sharp, enzymatic, biological, mechanical, or autolytic debridement. (See detailed discussion of debridement in Wound Bed Preparation section of these guidelines.) (Level I)

Principle: Necrotic tissue is laden with bacteria while devitalized tissue impairs the body’s ability to fight infection and serves as a pabulum for bacterial growth.

Evidence:


**Guideline #3.3:** If there is suspected infection in a debrided ulcer, or if contraction and epithelialization from the margin are not progressing within two weeks of debridement and relief of pressure, determine the type and level of infection in the debrided ulcer by tissue biopsy or by a validated quantitative swab technique. (Level II)

**Principle:** High levels of bacteria \(\geq 1 \times 10^6\) CFU/gram of soft tissue or any tissue level of beta hemolytic streptococci impede the various wound-healing processes and have been demonstrated to impede spontaneous healing and surgical closure of pressure ulcers. Cultures should be performed to isolate both aerobic and anaerobic bacteria.

**Evidence:**


**Guideline #3.4:** For ulcers with \(\geq 1 \times 10^6\) CFU/gram of tissue or any tissue level of beta hemolytic streptococci following adequate debridement, decrease the bacterial level with a topical antimicrobial. Once in bacterial balance, discontinue the use of topical antimicrobial to minimize any possible cytotoxic effects due to the antimicrobial agent or bacterial resistance to the agent. (Level I)

**Principle:** Systemically administered antibiotics do not effectively decrease bacterial levels in granulating wounds. However, topically applied antimicrobials can be effective.

**Evidence:**


**Guideline #3.5:** Obtain bacterial balance (\(<10^5\) CFU/gram of tissue and no beta hemolytic streptococci) in the pressure ulcer before attempting surgical closure by skin graft, direct wound approximation, pedicled, or free flap. (Level I)

**Principle:** “A wound containing contaminated foci with \(>10^5\) organisms per gram of tissue cannot be readily closed, as the incidence of wound infection that follows is 50–100%.”

**Evidence:**


**Guideline #3.6:** Obtain bone biopsy for culture and histology in cases of suspected osteomyelitis associated with a pressure ulcer. (Level II)
Principle: The sensitivity and specificity of noninvasive tests for diagnosing osteomyelitis are not as high as direct bone biopsy and are not as useful in determining treatment.

Evidence:

Guideline #3.7: Once confirmed, osteomyelitis underlying a pressure ulcer should be adequately debrided and covered with a flap containing muscle or fascia. (Antibiotic choice, guided by culture results, should be used for three weeks.) (Level I)

Principle: Muscle, musculocutaneous, and fasciocutaneous flaps effectively control bacterial levels and antibiotics have been demonstrated by meta-analysis not to show additional efficacy beyond three weeks.

Evidence:

4. WOUND BED PREPARATION

Preamble: Wound bed preparation is defined as the management of the wound to accelerate endogenous healing or to facilitate the effectiveness of other therapeutic measures. The aim of wound bed preparation is to convert the molecular and cellular environment of a chronic wound to that of an acute healing wound.

Guideline #4.1: Examination of the patient as a whole is important to evaluate and correct the causes of tissue damage. It is important to examine the patient’s systemic diseases and medications. (Level I)

Principle: General medical history, including a medication record, will help in identifying and correcting systemic causes of impaired healing. Any major illness, systemic disease, or drug therapies that cause alterations in immune function, metabolism, nutrition, and tissue perfusion will interfere with wound healing. Systemic disease, such as systemic sepsis, organ failure (hepatic, renal, respiratory, gut), major trauma/burns, diabetes, autoimmune diseases, and drug therapies such as immunosuppressive drugs and systemic steroids, will delay wound healing. Autoimmune diseases such as rheumatoid arthritis, systemic lupus, uncontrolled vasculitis, or pyoderma gangrenosum can impair healing and may require systemic steroids or immunosuppressive agents for adequate control before local wound healing can occur. Patients undergoing major surgery have diminished wound-healing capacity. Smoking is associated with impaired wound healing and increased risk of infection.

Evidence:

**Guideline #4.2:** Examination of the patient as a whole is important to evaluate and correct causes of tissue damage. It is important to examine the patient’s nutritional status. (Level II)

**Principle:** Nutrition must be adequate to provide sufficient protein to support the growth of granulation tissue. Encourage nutritional support if an individual is undernourished. (Detailed discussion of nutrition is in Nutritional Guidelines.)

**Evidence:**

**Guideline #4.3:** Examination of the patient as a whole is important to evaluate and correct causes of tissue damage. It is important to examine the patient’s tissue perfusion and oxygenation. (Level I)

**Principle:** Adequate tissue perfusion and oxygenation: Wounds will heal in an environment that is adequately oxygenated. Oxygen delivery to the wound will be impaired if tissue perfusion is inadequate. Dehydration and factors that increase sympathetic tone such as cold, stress, or pain will decrease tissue perfusion. Cigarette smoking decreases tissue oxygen by peripheral vasoconstriction.

**Evidence:**

**Guideline #4.4:** Initial debridement is required to remove the obvious necrotic tissue, excessive bacterial burden, and cellular burden of dead and senescent cells. Maintenance debridement is needed to maintain the appearance and readiness of the wound bed for healing. The health care provider can choose from a number of debridement methods including sharp, mechanical, enzymatic, and autolytic. More than one debridement method may be appropriate. (Level I)

**Principle:** Necrotic tissue, excessive bacterial burden, senescent cells, and cellular debris can all inhibit wound healing. The method of debridement chosen may depend on the status of the wound, the capability of the health provider, the overall condition of the patient, and professional licensing restrictions.


Surgical/Sharp Debridement: involves the use of instruments (scissors, scalpels, forceps) or laser to remove necrotic tissue from the wound. Debridement of large amounts of necrotic tissue should be performed in the operating room. Surgical debridement is indicated when the goal is to achieve fast and effective removal of large amounts of necrotic tissue. Surgical debridement is contraindicated if there is lack of expertise in this method, inadequate vascular supply to the wound, and absence of systemic antibacterial coverage in systemic sepsis. Relative contraindication is bleeding disorders or anticoagulation therapy.

Evidence:


**Guideline #4.5:** Wounds should be cleansed initially and at each dressing change using a neutral, nonirritating, non-toxic solution. Routine wound cleansing should be accomplished with a minimum of chemical and/or mechanical trauma. (Level III)

**Principle:** Cleansing the wound removes loose impediments to wound healing. Clinical experience has shown that mild soap (non-perfumed, without added antibiotics, and at skin pH: 4.5–5.7) and water for cleansing, used regularly, is effective, safe, and cheap. Sterile saline or water is recommended. Tap water should only be used if the source water is reliably clean. Wound antisepic agents, e.g., hydrogen peroxide, hypochlorite solution, acetic acid, chlorhexamide, providone/iodine, cetrimide, and others have antibacterial properties but are all toxic to healthy granulation tissue.

**Evidence:**

1. Rodeheaver GT. Pressure ulcer debridement and cleansing: a review of current literature. *Ostomy Wound Manage* 1999 Jan; 45 (1A Suppl.): 80S–85S; quiz86S–87S. [LIT REV]


**Guideline #4.6:** Infection control should be achieved by reducing wound bacterial burden and achieving wound bacterial balance. (For detailed guidelines, see Infection.) (Level I)

**Principle:** Infection will cause wound-healing failure, often with progressive deterioration of the wound. Systemically administered antibiotics do not effectively decrease bacterial levels in granulating wounds. Other methods that may be suitable include enhancing host defense mechanisms, debridement, wound cleaning, and topical antimicrobials. For ulcers with $1 \times 10^8$ or higher CFU/gram of tissue or any tissue-level beta hemolytic streptococci following adequate debridement, decrease the bacterial level by a topical antimicrobial. Once in bacterial balance, i.e., $10^5$ CFU or less/gram of tissue, and no beta hemolytic streptococci in the ulcer, discontinue the use of topical antimicrobial to minimize the possibility of emergence of resistance. In chronic wounds, the pathogen species may be more important than the number of bacteria. Obtain bone biopsy for culture and histology (gold standard) in case of suspected osteomyelitis. Treat confirmed debrided osteomyelitis with flap containing muscle or fascia and culture-determined antibiotics.

**Evidence:**


**Guideline #4.8:** Achieve local moisture balance by management of exudate. (Level I)

**Principle:** Local moisture balance is necessary to facilitate granulation and reepithelialization of the ulcer. A moist wound environment accelerates wound healing with more rapid epithelialization. Many dressings now combine wound bed preparation, i.e., debridement and/or antimicrobial activity, with moisture control. Moist wound dressings should keep the ulcer bed continuously moist and at the same time control the exudate to prevent desiccation of the ulcer bed and maceration of the peri-ulcer skin. Use clean, dry dressings for 8–24 hours after sharp debridement associated with bleeding; then reinstitute moist dressings. Clean dressings may also be used in conjunction with mechanical or enzymatic debridement techniques. (For detailed guidelines, see Dressings.)
Evidence:


Guideline #4.9: There should be an ongoing and consistent documentation of wound history, recurrence, and characteristics (location, staging, size, base, exudates, infection condition of surrounding skin, and pain). The rate of wound healing should be evaluated to determine whether treatment is optimal. (Level III)

**Principle:** Ongoing evaluations of wound bed preparation are necessary because if the ulcer is not healing at the expected rate, interventions for wound bed preparation need to be reassessed. The longer the duration of the ulcer, the more difficult it is to heal. If an ulcer is recurrent, patient education or issues of prevention and long-term maintenance need to be reassessed.

Evidence:


5. DRESSINGS

**Preamble:** There is a plethora of choices for topical treatment of pressure ulcers. Many dressings now combine wound bed preparation, i.e., debridement and/or antimicrobial activity, with moisture control. Guidelines assist the clinician in making decisions regarding the value and best use of these advanced wound care products.

**Guideline #5.1:** Use a dressing that will maintain a moist wound-healing environment. (Level I)

**Principle:** A moist wound environment physiologically favors migration and matrix formation while accelerating healing of wounds by promoting autolytic debridement. Moist wound healing also reduces wound pain.

**Evidence:**


**Guideline #5.2:** Use clinical judgment to select a moist wound dressing. (Level I)

**Principle:** Results from existing studies have not demonstrated any specific moisture retentive topical therapy to
be superior in terms of healing rate. Wet-to-dry dressings are not continuously moist and are an inappropriate wound-dressing selection.

**Evidence:**


Guideline #5.3: Select a dressing that will manage the wound exudate and protect the peri-ulcer skin. (Level I)

**Principle:** Peri-wound maceration and continuous contact with wound exudate can enlarge the wound and impede healing.

**Evidence:**


Guideline #5.4: Select a dressing that remains in place and minimizes shear, friction, skin irritation, and additional pressure. (Level II)

**Principles:** Wound location, peri-wound skin quality, incontinence of urine or stool, and patient activity can all affect the choice of dressing. Some dressings have been designed to be self-adherent, some are designed to fill a cavity. Additional tissue damage may result if the dressing causes increased pressure on the wound or damages adjacent tissue.

**Evidence:**


**Guideline #5.5:** Select a dressing that is cost effective. (Level I)

**Principles:** Because the initial cost of moist gauze is lower than advanced wound care products, there is a perception that moist gauze is more cost effective. When determining cost efficacy, it is important to take into consideration health care provider time, patient care goals and resources, ease of use and healing rate, as well as the unit cost of the dressing.

**Evidence:**

**6. SURGERY**

**Preamble:** Surgical treatment of pressure sores is a final invasive choice for wounds refractory to less aggressive care or for use when rapid closure is indicated. Peri-operative morbidity and greater risk of complications are inherent to the use of surgical options. Surgical procedures can be divided into those that prepare the patient for successful healing, and those that provide definitive closure. Reports of randomized clinical trials for operative treatment of pressure ulcers are almost nonexistent in the literature. However, given the magnitude of these treatment options, guidelines are mandatory to address their appropriate use.

**Guideline #6.1:** Irregular wound extensions, forming sinuses or cavities, must be explored and unroofed and treated. (Level III)

**Principle:** Tissue not exposed to treatment agents or devices cannot be expected to respond to the regimen and proceed to healing.

**Evidence:**

**Guideline #6.2:** Necrotic tissue must be debrided. (Level I)

See Guideline #4.4 in Wound Bed Preparation.

**Principle:** Nonviable tissue is detrimental to wound healing. Therefore, it should be debrided to allow the wound to proceed to closure. (See Wound Bed Preparation.)

**Evidence:**

**Guideline #6.3:** Infected tissue must be treated by topical antimicrobials, systemic antibiotics, or surgical debridement. (Level I)

(See Guidelines #3.2 and #3.4 in Infection.)

**Principle:** Infected soft tissue or bone will prevent wound healing, whether it is spontaneous or with the aid of surgical intervention. Only tissue with a low bacterial count (≤ 10⁷/gm tissue) and with no β-hemolytic streptococcus will proceed to closure.

**Evidence:** See Guidelines #3.2, #3.3, #3.4, #3.5, #3.6, and #3.7 in Infection.

**Guideline #6.4:** Underlying bony prominence and fibrotic bursa cavities should be removed. (Level II)

**Principle:** Soft tissue compression between the skeleton and support surfaces leads to pressure necrosis. Removal of prominences, without excessive excision, alleviates pressure points.

**Evidence:**

**Guideline #6.5:** Bone excision must not be excessive. (Level III)

**Principle:** Extensive bone excision, especially at the ischial location, can expose deeper structures such as the urethra, or cause a shift of weight bearing, resulting in excessive pressure elsewhere.
Evidence:


Guideline #6.6: Fecal and urinary diversions are rarely needed to obtain a healed wound. (Level II)

Principle: Unless a fistulous track has developed, urinary or fecal contamination commonly occurs on the surface. Use of a bowel program or catheterization can divert urine and fecal material without the need for additional surgery.

Evidence:

1. Controller, Department of Medicine and Surgery: Mortality report in spinal cord injury; Reports and Statistics Service, Veterans Administration, Nov. 13, 1958. [STAT]
2. Conway H, Griffith BH. Plastic surgery for closure of decubitus ulcer in patients with paraplegia; based on experience with 1,000 cases. Am J Surg 1956; 91: 946–75. [CLIN S]

Guideline #6.7: Consider radical procedures such as amputation or hemipelvectomy only in the rare and extreme cases. (Level II)

Principle: Amputation, hemipelvectomy, or hemipelvectomy have significant morbidity and mortality, shift pressure points, and rarely address the underlying problem leading to extensive, recurrent pressure sores.

Evidence:


Guideline #6.8: A pressure sore should be closed surgically if it does not respond to wound care and there is no other contraindication to the surgical procedures. Exceptions may include the elderly or patients with a fatal illness, for whom palliative, local wound care is more appropriate. (Level II)

Principle: Wound closure decreases protein loss, fluid loss, the possibility of wound infection, and the later development of malignancy in the wound.

Evidence:


Guideline #6.9: Composite tissue closure leads to the best chance of sustained wound closure, although recurrence and recidivism are continuing problems. (Level II)

Principle: The most durable wound closure fills the ulcer with bulk and provides padding over the underlying structures with a tension-free closure.

Evidence:

2. Conway H, Griffith BH. Plastic surgery for closure of decubitus ulcers in patients with paraplegia: based on experience with 1,000 cases. Am J Surg 1956; 91: 946–75. [RETRO S]


*Guideline #6.10: Management to address muscle spasm and fixed contractures must occur preoperatively and continue at least until the wound is completely healed. (Level III)*

**Principle:** Spasm may put traction on a wound to cause dehiscence of the suture line. Spasms and fixed contractures may limit postoperative positioning and leave the patient at risk for new pressure sore formation.

**Evidence:**


3. Conway H, Griffith BH. Plastic surgery for closure of decubitus ulcers in patients with paraplegia; based on experience with 1,000 cases. *Am J Surg* 1956; 91: 946–75. [RETRO S]


**7. ADJUVANT AGENTS (TOPICAL, DEVICE, SYSTEMIC)**

*Preamble:* Emerging evidence on adjuvant therapies suggests potential benefit for pressure ulcer healing. To date, there are insufficient studies demonstrating superiority over other more traditional wound treatments. Until further evidence of efficacy is established, consider the use of adjuvant therapy after evaluating individual patient and ulcer characteristics and when (1) healing fails to progress using conventional therapy and (2) under circumstances where the economic or physical burden of adjuvant therapy is consistent with patient goals and circumstances.

**Topical Agents**

*Guideline # 7a.1: Consider the use of growth factor therapy for pressure ulcers that are not responsive to initial comprehensive therapy and/or before surgical repair. (Level II)*

**Principles:** Growth factors are required for normal healing, and chronic wounds have shown growth factor deficiencies and imbalances. Achievement of some degree of ulcer closure, even if not complete, increases the ease of surgical closure. However, to date, no growth factor has received approval for pressure ulcer treatment.

**Evidence:**


### Devices

**Guideline #7b.1:** Consider using negative pressure wound therapy (NPWT) for stage III or IV pressure ulcers that fail to progress in healing with conventional therapy. (Level I)

**Principle:** NPWT applies negative pressure to the wound removing wound exudates and debris. Current evidence indicates that NPWT may support pressure ulcers healing by increasing wound perfusion and formation of granulation tissue and by reducing bacterial load.

**Evidence:**


**Guideline #7b.2:** Electrical stimulation may be useful in the treatment of pressure ulcers that have not healed with conventional therapy. (Level I)

**Principle:** Improvement in the healing of chronic wounds is reported in response to electrical stimulation. The most effective type of electrical stimulation treatment and specific types of chronic wounds that are most likely to respond to this therapy have not been determined.

**Evidence:**


### Systemic

**Guideline #7c.1:** Hyperbaric oxygen therapy has not been shown to have a statistically significant effect on pressure ulcer healing. Further studies are needed to evaluate the efficacy of hyperbaric oxygen in pressure ulcers. (Level I)

**Evidence:**


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The goal of this guideline is to provide evidence based recommendations for the prevention and treatment of pressure ulcers that can be used by health professionals throughout the world. The purpose of the prevention recommendations is to guide evidence based care to prevent the development of pressure ulcers and the purpose of the treatment focused recommendations is to provide evidence-based guidance on the most effective strategies to promote pressure ulcer healing. For optimal treatment of pressure ulcers there are 4 main concerns: 1. Underlying pathology of the pressure ulcer must be treated if possible. 2. Pressure must be relieved or removed by appropriate measures to prevent further injury. However, weekly assessments provide an opportunity for the health care professional to detect early complications and the need for changes in the treatment plan. The treatment needs of a pressure ulcer change over time. Treatment strategies should be continuously re-evaluated based on the current status of the ulcer. 16 17. Wound infection. Treatment of Pressure Ulcers. Clinical Practice Guideline Number 14. Agency for Health Care Policy and Research, Public Health Service. Rockville, MD: US Department of Health and Human Services; 1994. AHCPR Publication No. 95-0642.: Frantz RA. Pressure ulcer costs in long term care.Â Deloach ED, DiBenedetto RJ, Womble L, Gilley JD. The treatment of osteomyelitis underlying pressure ulcers. Decubitus. 1992 Nov. 5(6):32-41. [Medline]. Yarkony GM. Pressure ulcers: a review.