

A Primary Care Provider's Guide to Prevention and Management of Pressure Injury and Skin Breakdown in People With Spinal Cord Injury

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Abstract: Skin breakdown, including burns and pressure injuries (Prls), is a devastating complication of spinal cord injury (SCI). Chronic wounds place the person with SCI at high risk of infections, sepsis, and death. Skin health and breakdown is individual and multifactorial, thus prevention requires individualized education focused on patient preferences and goals. Assessment requires an accurate description of wound type/Prl stage, location, size, wound bed, wound margin, epithelialization, exudate, and peri-wound condition. Prls should be staged using the National Pressure Injury Advisory Panel (NPIAP) staging system. Successful treatment requires optimal wound bed preparation, pressure off-loading, and access to surgical specialists if needed. Mattress and seating systems, pressure relief, skin microclimate, nutrition, and home supports should be optimized. To promote wound healing and aid prevention, identifiable causes need to be removed, risk factors improved, and wound care provided. Infection should be treated with input from infectious disease specialists. Consideration for specialized surgical management including flaps and primary closures should be coordinated with the interdisciplinary team to optimize outcomes. If comorbid conditions promote wound chronicity, a palliative rather than curative treatment plan may be needed. **Key words:** paraplegia, pressure ulcer, primary care health, quadriplegia, spinal cord injuries, wounds and injuries

Health Maintenance Checklist

1. Perform a full skin exam on initial evaluation and annually.
2. Identify key interdisciplinary team members (seating specialist, occupational therapist, physical therapist, wound center, wound nurse, social worker) for patients with impaired mobility and sensation who are at high risk of skin breakdown.
3. Assess risk factors for skin breakdown, including durable medical equipment (wheelchair cushions, mattresses, commode chairs, etc.).
4. Assess sufficiency of home care support.

Episodic Care Key Points

1. Assess cause of wound with input from interdisciplinary team for deep-tissue pressure injury or partial/full thickness wounds.
2. Assess and document wound location, size, appearance of wound bed, wound edges and peri-wound, and pressure injury stage using National Pressure Injury Advisory Panel Guidelines.
3. Develop wound treatment plan focused on control of infection, removal of necrotic or nonviable tissue, moisture management of the wound environment, and frequency of treatment.
4. Obtain additional home care support services (home care nursing, home health aides) or extended care facility placement if needed.

Case Report

A 38-year-old male with a 14-year history of C6 complete tetraplegia returns to your clinic to report that, during his last bowel care, his home care nurse found a dark purple spot on his coccyx that he wants you to look at. He had a history of

a small sacral “bed sore” at the time of his initial spinal cord injury (SCI), but it healed during his rehab. He had no skin breakdown from then until now. Nothing has changed in his health or daily routine that he can think of, and he has no idea what caused the wound.

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Introduction

Skin breakdown, including burns and pressure injuries (PrIs), are devastating complications of SCI. It decreases community integration and quality of life while increasing risk of complications, including soft tissue infections, osteomyelitis, sepsis, and death. Managing the multiple factors promoting the development and chronicity of PrIs requires a multidisciplinary approach.^{1,2} A treatment plan for wound care should be developed with the person with SCI, which—with contributing factors in mind—may include palliative wound care.³ The development of an interdisciplinary team for persons with SCI who live in rural areas or lack access to transportation for medical appointments may require significant effort by the primary care provider (PCP). In addition, lack of access to specialized SCI care increases risk of PrI development,¹ and long-distance travel via wheelchair or gurney can create or worsen PrIs.²

Initial Assessment

Assessment of skin problems in individuals with SCI requires adequate time for examination. Skin breakdown is often caused by multiple factors and requires PCPs to familiarize themselves with the individual's overall health, mobility, and social support. PCPs should plan for a comprehensive history and full body evaluation whether or not the patient has wounds. Before the patient's visit, PCPs should try to confirm the patient's mobility needs to permit planning for transfers in the clinic. Also, the patient should bring in a list of any durable medical equipment used at home including the name, model, and vendor, if available.

The ultimate management of skin breakdown in people with SCI is prevention. This requires familiarity with the individual's level of SCI, functional ability, and burn and pressure injury risk factors. An exploration of the patient's personal goals of care regarding their skin and their understanding of their overall health as well as the identification of barriers to implementing health care plans will optimize patient care.³

Although there are risk assessment tools⁴ to help identify a person's likelihood of developing PrIs,

more than 200 risk factors are known to contribute to PrI development.⁵ See **Table 1** for factors contributing to overall health and PrI prevention.^{6,7}

Prevention

The cornerstone for skin breakdown prevention in persons with SCI is education that takes into account the individual's preferences and life goals. The team should regularly assess the person's overall perception of quality of life and self-efficacy; this perception may be an indication of the patient's ability and willingness to implement preventive measures (**Table 2**), such as performing regular pressure relief and skin checks, checking equipment and wheelchair cushions, maintaining nutrition, achieving moisture control, and avoiding smoking.⁸⁻¹⁰

Identifying and Assessing a Pressure Injury

PrIs occur over bony prominences or surfaces that experience pressure from equipment, body parts, or decreased mobility. This includes but is not limited to the ischial tuberosities, sacrum, heels, hips, knees, ankles, spine, back of the head, and scapulae. PrIs can occur due to prolonged pressure, high pressure for short periods (e.g., falls), or pressure in combination with shearing. They should be staged according to the National Pressure Injury Advisory Panel (NPIAP) staging system¹¹ to document their severity. Refer to NPIAP for full definitions of the different stages of PrI (<https://www.npiap.com/>). **Table 3** provides abridged descriptions of the stages.

Wound Assessment

Wound assessment should begin with the identification of the type of wound: PrI, bacterial or fungal infections, venous stasis, arterial insufficiency, diabetic, incontinence dermatitis, burns, or other lesions (e.g., melanoma). Wounds must be visually inspected, palpated, and assessed for malodor. Wound assessment should include location, size, stage, presence of eschar, slough, granulation tissue, epithelialization, appearance of wound margins, exudate type and amount, and state of peri-wound tissue.

Table 1. Key risk factors for skin breakdown in people with spinal cord injury (SCI)

Risk category	Key factors
Skin breakdown history	Burns Skin and soft tissue infections Pressure injuries, stage 3 or 4 Prior wound surgery Skin management ^a
Factors related to neurologic impairment	Neurological level of SCI Duration of SCI Protective sensation Skin protection behaviors (i.e., weight shifts) Muscle atrophy Spasticity and contracture management Use of mechanical medical devices (compression socks, splints, and braces ^a)
Functional status	Level of independence Ability to perform transfers Ability to perform pressure relief Assistance required
Comorbidities adversely impacting tissue nutrition and perfusion	Tobacco use Impaired renal, cardiovascular, or pulmonary function Sepsis Poor nutritional status Extremes of weight ^a Pregnancy
Moisture ^a	Bowel and bladder management ^a Frequency of incontinence ^a
Nutrition ^a	Ability to prepare meals ^a Ability to feed self ^a
Durable medical equipment for everyday mobility and self-care (including state of repair ^a)	Wheelchairs Seat cushions Bathroom equipment Transfer equipment Beds and mattresses
Psychosocial assessment	Male gender Unmarried status ^a Substance use Social supports ^a Homecare services ^a Daily activities ^a Income ^a Education level Vocational status Depression, posttraumatic stress disorder, or severe anxiety

^aAssessments that can be performed during the nursing intake.

Wounds should be photographed and measured in a consistent manner at each visit.⁶ Linear wound measurements of length and width may be obtained using cotton-tipped swabs to determine the greatest vertical distance and the greatest horizontal distance. When describing specific characteristics, such as tunneling or undermining, a clock is a useful reference. For example, “there

is undermining from 1 o’clock until 7 o’clock, deepest is 3 cm at 4 o’clock.”

Burn Assessment

Burns should be classified as superficial, superficial partial thickness, deep partial thickness, or full thickness. Fourth degree burns extend into

Table 2. Recommended pressure injury prevention interventions

Use pressure redistributing devices including specialty mattresses, specialty cushions for wheelchairs, shower commode chairs, and heel protective boots for use in bed.
Avoid multiple layers of pillows, “donut”-shaped cushions, and bed pans that impair tissue perfusion.
Perform skin checks every morning and evening in bed and 30 to 60 minutes after initiation of any new device or seating system.
Perform wheelchair pressure relief and/or weight shifting every 15 to 30 minutes for at least 2 minutes. Individuals who reposition often in the wheelchair are less likely to have a pressure injury history.
Perform bed repositioning every 2 hours increasing time as tolerated, alternating between left side, right side, and back.

Table 3. Abridged pressure injury descriptions

Stage	Description
Stage 1	Non-blanchable erythema of intact skin that does not resolve with pressure relief
Stage 2 <i>(Not used to describe moisture-associated skin damage, dermatitis, adhesive-related or traumatic wounds)</i>	Partial thickness skin loss with exposed dermis Fluid-filled blister or shallow open ulcer
Stage 3	Full thickness skin loss Fatty tissue and some slough can be present. Bloody or serosanguinous drainage is common. Deeper tissues are not exposed.
Stage 4	Full thickness skin and tissue loss with exposed bone, tendon, fascia, muscle, ligament, cartilage, or hardware Slough or eschar is often present but does not obscure wound depth. Undermining and tunneling often occur.
Unstageable	Full thickness skin and tissue loss obscured by either slough or eschar (tough fibrous brown or black substance) that covers >50% of the wound bed.
Deep-tissue pressure injury	Persistent non-blanchable deep red, maroon, or purple discoloration in a localized area. May or may not progress to full thickness injury.

deep tissue below the dermis including muscle, adipose, tendon, and bone.¹²

Describing the Wound Bed

The wound bed needs to be cleaned prior to assessment. Assessment can be methodized using the TIME framework (Tissue, Infection/Inflammation control, Moisture imbalance, and Epithelial advancement)¹³ (see **Table 4**). This method helps define active wound issues, aids with developing a wound care plan,¹⁴ and tracks wound healing or worsening when combined with wound measurements. Note that wound margins are considered normal if the free edges gradually meet across the wound bed.

Wound Treatment

Successful treatment of skin breakdown requires optimal wound bed preparation, pressure off-loading, nutrition, durable medical equipment, and access to surgical specialists, if needed. See **Figure 1** for a suggested wound management algorithm.

To optimally treat a new or chronic wound, the primary care team must engage persons with SCI and their support network to investigate the factors (**Table 1**) driving development and persistence of the wound—particularly noting positioning on support surfaces and in wheelchair seating systems—and provide them with appropriate wound care to promote wound healing and aid

Table 4. TIME framework for wound bed description and management

Framework component	Common descriptors	Wound management options
Tissue: Description and general appearance	Eschar Slough Fibrinous slough Biofilm Granulation tissue Epithelialization Identifiable structures seen or palpated Maceration Deep-tissue pressure injury	Debridement Wound cleansing Negative pressure wound therapy (NPWT)
Infectious/Inflammatory signs: Local Regional Systemic	Non-healing or worsening Warmth Erythema Swelling or induration Increased pain Friable red tissue Foul odor Increased drainage Purulent drainage Palpable or visible bone New satellite wounds, cellulitis, or rash Sepsis	Debridement Wound cleansing Topical anti-biofilm products Topical antimicrobials Systemic antibiotics
Moisture: Exudate type and amount	Serous Serosanguinous Sanguineous Purulent Dressing saturation Maceration Dry wound bed	Adjust dressing absorbency & hydrating properties Manage infection Protect peri-wound Manage edema NPWT
Edges & Epithelialization: Advancing Nonadvancing	Attached Detached Epithelialization Rolled wound edges Dried callus and debris Macerated	Debridement Skin grafting Biologic products NPWT

prevention. When comorbid conditions promote wound chronicity (diabetes, tobacco use, arterial or venous insufficiency, and poor perfusion due to unrelieved pressure), a palliative rather than a curative wound treatment plan may be needed.^{3,6,7}

The wound stage or severity is used to develop the wound treatment plan. Healing full-thickness wounds can be challenging and may require specialty consultation. Unmanaged biofilm amplifies wound inflammation, leading to breakdown of newly formed extracellular matrix and promoting wound chronicity. Sharp debridement is used to remove the necrotic debris when eschar is present. Debridement should be avoided for stable, dry, nonfluctuant eschar on the heels or areas with little tissue coverage

over bony prominences. These areas should be left intact, painted with povidone iodine, and kept dry. Cautious wound debridement may be performed in the clinic in people with SCI who lack pain sensation, taking care to avoid triggering autonomic dysreflexia. If the wound bed is covered with loose slough or biofilm, a wound specialist should be consulted regarding enzymatic or autolytic debriding agents and anti-biofilm surfactant cleansers. Once the wound bed is optimized, wound healing occurs if the wound bed is kept clean, moist, and at body temperature.

Selection of a dressing for the wound is guided by wound environment needs, support for wound care treatments, and cost (see **Table 5**). Wound dressings need to be cautiously removed to avoid

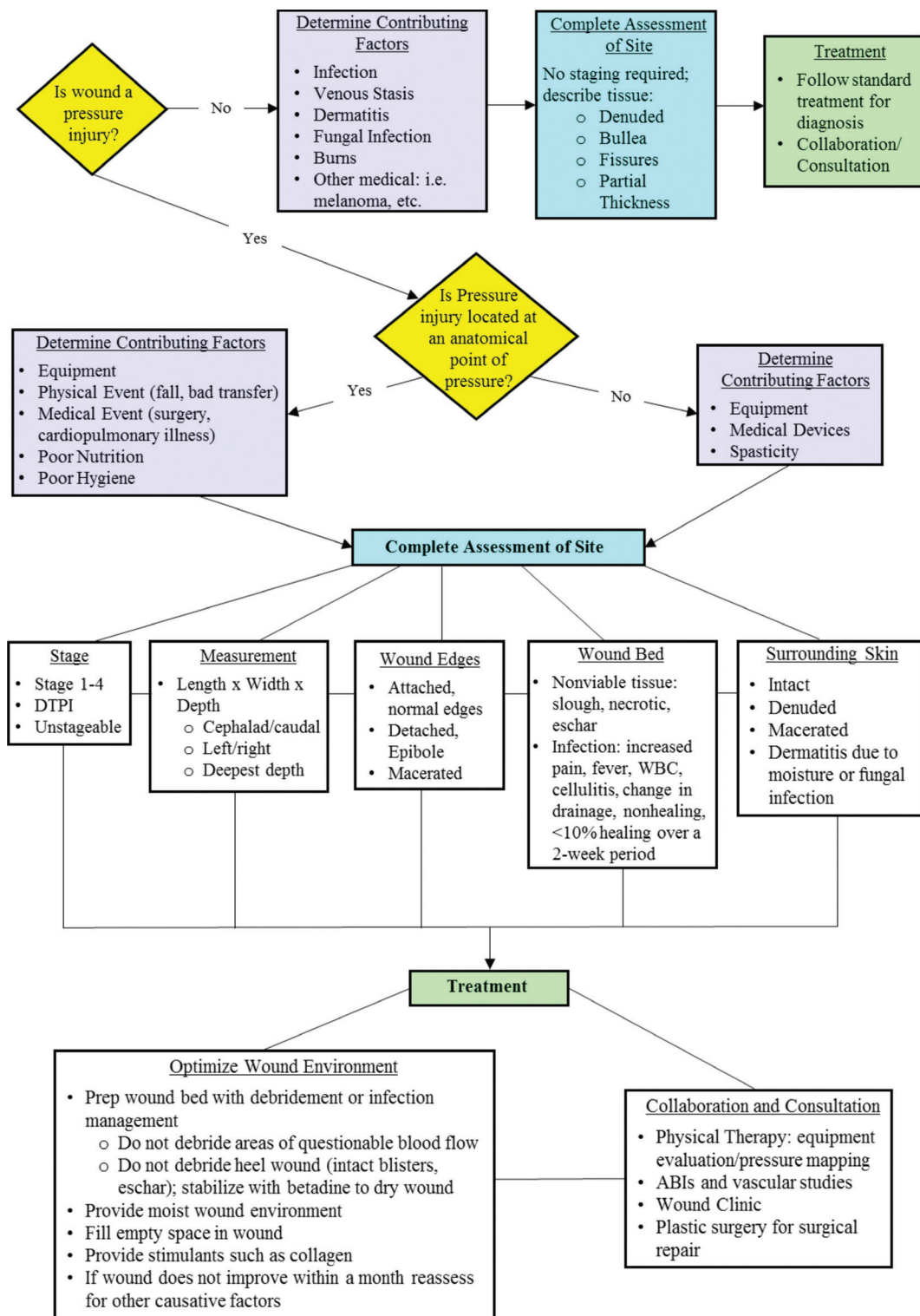


Figure 1. Pressure injury assessment and treatment algorithm. ABIs = Ankle Brachial Index; DTPI = deep-tissue pressure injury; WBC = white blood cells.

Table 5. Commonly available wound products and their use^{10,17}

Category (Brand name)	Uses	Application, frequency, and contraindications
Gauze	<ul style="list-style-type: none"> • Partial and full thickness • Mild-moderate drainage 	<ul style="list-style-type: none"> • Outer dressing • Daily • Avoid overpacking
Alginates & hydrofibers (Restore Calcium Alginate, Tegaderm Alginate, Aquacel)	<ul style="list-style-type: none"> • Partial and full thickness • Moderate-heavy drainage • Filling tunnels or undermining • Available with silver 	<ul style="list-style-type: none"> • Directly onto wound bed • Secure with top dressing. • Every 1-2 days • Not for dry eschar or heavy bleeding
Transparent films (Hypafix, Opsite, Tegaderm)	<ul style="list-style-type: none"> • Superficial • Little drainage • Intact skin protection • Dressing securement 	<ul style="list-style-type: none"> • Over bare skin or skin-prep gel • Weekly or as needed • Can cause maceration • Remove gently from fragile skin
Hydrocolloids (DuoDerm, Tegaderm hydrocolloid, Comfeel)	<ul style="list-style-type: none"> • Partial and shallow full thickness • Moderate drainage • Intact skin protection • Dressing securement • Autolytic debridement of mild necrotic tissue 	<ul style="list-style-type: none"> • Over bare skin or skin-prep gel • As a top dressing • Every 3-7 days • Not for heavy exudate, fragile skin, or primary dressing for deep wounds
Hydrogels (Curafil, DuoDerm Hydroactive Gel, Restore Hydrogel, Tegaderm Hydrogel)	<ul style="list-style-type: none"> • Partial and full thickness • Dry wound bed • Infected/necrotic wounds • Autolytic debridement of mild necrotic tissue • Available with antimicrobial 	<ul style="list-style-type: none"> • Directly to wound bed • Top dressing to avoid desiccation • Cover with an occlusive film for autolytic debridement • Every 1-3 days • Avoid with heavy exudates • Can cause maceration
Foams (Allevyn, Hydrofera Blue, Hydrocell, Mepilex, PolyMem, Ultra Foam with AFM)	<ul style="list-style-type: none"> • Partial and full thickness • Heavy drainage • Infected/necrotic wounds • Filling tunnels and undermining • Available with antimicrobial 	<ul style="list-style-type: none"> • Directly to wound bed • May need top dressing • Every 3-7 days • Not for dry eschar or nondraining wounds • Can cause maceration
Composite dressings (Xtrasorb, Mesorb, CombiDERM, Tegaderm+Pad)	<ul style="list-style-type: none"> • Partial and shallow full thickness • Little drainage • Infected/necrotic wounds • Hypergranulation tissue 	<ul style="list-style-type: none"> • Directly to wound bed • Used as a top dressing • Every 3-7 days • Remove gently from fragile skin
Cadexomer iodine (Inadine, Iodoflex, Iodosorb)	<ul style="list-style-type: none"> • Partial and full thickness • Biofilm or necrotic slough 	<ul style="list-style-type: none"> • Directly to wound bed • Cover with absorptive top dressing • Every 1-5 days • Reassess in 7-14 days • Use <50 g/application and <150 g/week • Avoid if iodine sensitivity
Collagenase (Santyl)	<ul style="list-style-type: none"> • Enzymatic debridement for slough and eschar • Critically colonized and infected wounds 	<ul style="list-style-type: none"> • Directly to wound bed • Requires absorptive dressing • No more often than daily • Avoid using with silver products
Medical grade <i>Leptospermum</i> or manuka honey (Medi-Honey, thera-Honey)	<ul style="list-style-type: none"> • Full thickness • Infected/necrotic wounds • Biofilm reduction • Autolytic debridement of slough and eschar 	<ul style="list-style-type: none"> • Directly to wound bed • Every 1-7 days • Cover with absorptive dressing • Can cause maceration
Negative pressure wound therapy	<ul style="list-style-type: none"> • Partial and full thickness with depth • Moderate-heavy drainage • Postoperatively for incisional, graft, or dehiscence 	<ul style="list-style-type: none"> • Trained provider/nurse must apply • Every 48-72 hours • Avoid if malignancy, infection, or untreated osteomyelitis

further injuries from pressure or adhesive stripping of fragile epidermis. Wet-to-dry gauze dressings are rarely recommended for people with SCI due to the risk of mechanically debriding both necrotic and healthy tissue as well as creating a nidus of a pressure when the gauze compresses. Frequency of wound care is based on product recommendation, amount of drainage or infection, and availability of wound care dressing assistance. For deep but uninfected wounds, wound specialists may order negative pressure wound therapy to remove biofilm and control moisture, stimulate granulation tissue formation, and promote wound contraction. The wound should be assessed and measured every 1 to 2 weeks. If wound healing is not improved after 1 month of treatment, it should be re-evaluated and the treatment adjusted. If the wound is worsening, infection or poor adherence to treatment recommendation may be the cause. After re-evaluation, a referral to a wound care specialist should be considered.^{3,6,7}

Depending on the location and cause of a PrI, evaluation of the appropriateness of the person's durable medical equipment may be needed. This will likely require the provider to find community support with a physical medicine and rehabilitation physician, physical or occupational therapist, or wheelchair seating specialist. Because the care needs of people with SCI for PrI prevention and treatment can be complex, a multidisciplinary team is the standard of care.

Osteomyelitis

Acute and chronic osteomyelitis may contribute to nonhealing of stage 4 PrIs and has been found in 25%-47%^{15,16} of nonhealing severe PrIs. It can also complicate the plan of care if flap closure is desired. Imaging with radiographs, three-phase bone scan with SPECT, MRI with contrast, or tagged white blood cell (WBC) scan with SPECT are useful diagnostic tools. Definitive diagnosis relies on bone biopsy and culture. Treatment of osteomyelitis should include debridement of infected bone and 6 weeks of appropriate antibiotics.^{3,6,7}

Surgical Management

Consideration for surgical management including flaps and primary closures should be coordinated with an interdisciplinary team to ensure that the person's condition is optimized before surgery including tobacco cessation, durable medical equipment including seating check for dysfunction, stable psychological state, and ability to complete bed rest after flap. The postoperative care plan will likely require an extended care facility stay for supported bed rest followed by a progressive seating protocol to minimize the risk of flap failure.⁶

Complications

Chronic wounds can lead to multiple complications including bacteremia, sinus tracts and abscesses, septic arthritis, endocarditis, fistulas, and joint contractures. Squamous cell carcinoma, or Marjolin ulcers, can occur in long-term (years) chronic wounds and can be identified by increased pain, discharge, and bleeding with verrucous hyperplasia.⁶

Case Resolution

Your clinic nurse used your floor-based lift to transfer the patient to an exam table, and you identified a coccygeal deep-tissue pressure injury. You could not find a cause on initial assessment and referred him emergently to a wound care clinic. He returned to see you after 2 weeks and reported trying to do some bed rest, but he continued to work at his desk job about 6 hours per day with frequent pressure relief. The wound evolved to an unstageable PrI, which the wound care clinic treated with a topical enzymatic debriding agent. After a month, the unstageable injury did not improve. The patient was referred to a wheelchair seating clinic, where the contoured hybrid gel and foam cushion was found to be positioned backwards inside the cushion cover. In this orientation, the ridge that should separate his thighs pressed up against his coccyx. Further

questioning revealed that a new home health aide started working for him about 2 months ago, around the time the wound appeared. After correcting the wheelchair cushion orientation and surgical debridement, the wound was found to be a shallow stage 4 PrI, and it healed after 3 months of negative pressure wound therapy.

Conclusion

The successful prevention and treatment of wounds in people with SCI requires an interdisciplinary approach in order to minimize

risk factors, remove identifiable causes, and promote wound healing. Infection should be treated with input from infectious disease specialists. Consideration for specialized surgical management should be coordinated with the interdisciplinary team. Unmanageable comorbid conditions may promote wound chronicity requiring a palliative treatment approach.

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