Chapter 17

Pressure ulcers

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Introduction

Pressure ulcers develop as a result of tissue loss primarily from pressure. Decubitus ulcers occur in areas with underlying bony prominences when the patient is lying down (sacrum, trochanter, heel etc.). Other pressure ulcers occur in the seated position (ischial tuberosities).

Pressure ulcers are an ancient problem, reported in Egyptian mummies. Data from developed countries indicates that between three percent and five percent of all hospitalized patients will develop a pressure sore at some time during their hospitalization. The incidence of spinal cord injuries and pressure ulcers in sub-Saharan Africa is not known, but with the recent exponential increase in the number of accident victims from industrial, motor vehicle accidents, as well as with the flood of motor cycles on sub-Saharan Africa roads, the number of critically injured and spinal injured patients has seen a similar increase, and it is likely that there will be an attendant increase in patients with pressure ulcers. Further, a growing number of children/adults with spina bifida also contribute to this difficult problem, as children who once had no chance of survival previously now grow to adulthood as a result of improved focused care. A favorable pressure ulcer prevalence of 4.2% in Kenya’s premier referral hospital was reported, while the National spinal injury hospital had a pressure ulcer prevalence of 68% in a study in 2003. Nang’ole identified trauma (42.4%), HIV/AIDS (27.4%), tuberculosis of the spine (8%), diabetes mellitus (4%), cerebro-vascular accidents (4%), and others (14.2%) as the predisposing factors to the development of pressure ulcers causes in 113 patients in a Nairobi hospital in 2003. The patients had a total of 321 pressure ulcers.

Pressure ulcer prevention in Spinal Cord Injury (SCI) patients in resource-constrained environments is difficult, while the management once pressure ulcers occur is complex. Pressure ulcers are associated with increased mortality, morbidity, hospital stay, and cost. Non-monetary costs (‘hidden costs’) of pressure ulcer care include the emotional and physical impact of these ulcers on the patient and their caregivers. The surgeon must therefore be prepared to either manage or help prevent pressure ulcers, especially
considering that Physical Medicine and Rehabilitation specialists are largely lacking in most of sub-Saharan Africa.

The European Pressure Ulcer Advisory Panel (EPUAP) has graded pressure ulcers to assist with decision making and intervention (Table 1). It is important to note that the descriptions given are largely applicable to Caucasians and Asians; however, the type of care recommended for each grade, and the need for prevention, are universal.

**Table 1: Pressure ulcer grading**

<table>
<thead>
<tr>
<th>GRADE</th>
<th>LESION</th>
<th>MANAGEMENT</th>
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<tbody>
<tr>
<td>I</td>
<td>Non-blanchable erythema (redness) of intact skin. Discoloration of the skin, warmth, edema, induration or hardness may also be used as indicators, particularly on individuals with darker skin</td>
<td>Institute preventive nursing measures: avoid moisture, friction and pressure on body part at risk</td>
</tr>
<tr>
<td>II</td>
<td>Partial thickness skin loss involving epidermis, dermis, or both. The ulcer is superficial and presents clinically as an abrasion or blister</td>
<td>Avoidance of pressure and wound care. Surgical debridement of any dead skin. Rarely, skin graft</td>
</tr>
<tr>
<td>III</td>
<td>Full thickness skin loss involving damage to or necrosis of subcutaneous tissue that may extend down to, but not through underlying fascia</td>
<td>Surgical debridement and wound closure with random skin flap often sufficient</td>
</tr>
<tr>
<td>IV</td>
<td>Extensive destruction, tissue necrosis, or damage to muscle, bone, or supporting structures with or without full thickness skin loss</td>
<td>Excision of ulcer as described in text, with VAC or rotational flap, depending on site.</td>
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Independence, social acceptance, freedom from discomfort and a feeling of adequacy have been identified as the most important desires of patients with SCI. A causal relationship between pressure ulcer development and a combination of both environmental/extrinsic (pressure, shear, and frictional forces) and systemic/intrinsic (neurological impairment, age, weight, moisture (fecal/urinary incontinence) factors is accepted. The recognition that pressure
ulcer development is a very complex process has led to the formulation of a number of theories over the years, including:

1. The neuropathic theory (Munro) proposes an increased susceptibility of skin to pressure necrosis resulting from an interruption of autonomic reflex arcs and loss of circulatory reflex responses following spinal cord injury.

2. The pressure-induced ischemia theory states that constant pressures exerted on soft tissues for a sufficiently long time will result in pressure ulcers. The exerted pressure must be sustained, and must exceed 32 mmHg. A notable exception is in cerebral palsy patients, who do not develop pressure ulcers, even when placed in wheel chairs for long periods of time.

3. The theory of differential pressure tolerance is derived from the observation that different parts of the body bear different amounts of pressure, depending on the position taken by an individual, whether seated, standing or lying down.

4. The multi-factorial hypothesis involves a direct effect by one or more extrinsic (primary) factors, potentiated and modified by a number of intrinsic (secondary) factors, and is the currently most accepted mechanism.

Identified risk factors for the development of pressure ulcers are primarily environmental/extrinsic (pressure, shearing forces and frictional forces) and systemic/intrinsic (neurological impairment, age, weight, moisture from fecal/urinary incontinence), predisposing conditions, etc).

The complexity of pressure ulcer evolution is further evidenced by the lack of agreement on their pathophysiology: the deep tissue injury theory, favored by most workers, holds that pressure ulcers initially develop around bone, and then progress outwards, to the skin, while the ‘top-to-bottom’ model suggests that tissue injury starts from the skin and progresses into deeper tissue. The deep tissue injury theory explains the reason for extensive muscle and subcutaneous tissue damage, with minimal skin involvement, lending weight to the expression ‘tip of the iceberg’, which aptly describes most pressure ulcers. The prevention of pressure ulcers is better than their cure and basic skin care and adequate pressure dispersion are the primary tenets of prevention.

Pre-requisites for surgical intervention
Bladder care should be taught, with an emphasis on clean intermittent self-catheterization (CISC). Condom catheters are fraught with complications,
especially urethral fistulae, while indwelling catheters are only used in the post-operative period, until the patient is able to perform CISC again. Suprapubic cystostomy is only performed after an urethroplasty or in a patient where the penis/penile urethra have been destroyed by pressure.

Bowel care is more difficult, as the anus is less accessible, and constant soiling contributes in a large part to wound infection, dehiscence and recurrence. A colostomy is only performed in the uncooperative patient who permits constant soiling and pressure leading to either dehiscence or an early recurrence in the postoperative period. A colostomy may be required initially, as a lifesaving procedure in the septic patient. Some patients have noted such improvement in their ability to manage their toileting, that they have requested their colostomies be permanent.

The most important question facing the surgeon in the care of the paraplegic with pressure ulcers is whether to operate or not – and if not, when, if ever. The decision not to operate may be based on a number of factors, and most in the opinion of the author are patient idiosyncrasies. Surgical intervention must fulfill more than one of the above-stated goals of pressure ulcer care. While each patient with pressure ulcer(s) must be evaluated and managed individually, some general principles are helpful in the decision making process, especially in resource-constrained environments.

**Non-surgical management of pressure ulcers** depends on the following: predisposing cause(s) (e.g. paralysis), level of paralysis, presence or absence of fecal and/or urine incontinence, severity of the ulcer (grade), patient idiosyncrasies (e.g. depression, family support), quality of nursing care (hospital and at home), financial endowment and equipment, amongst other factors.

Upon completing the evaluation of a patient with pressure ulcers, it may become evident that while surgery may improve a patient’s body image in the short term by removing the ulcer along with its foul smell, the risk of recurrence is too high, and therefore would not be useful. The decision not to operate may be based on a number of factors, most of which are patient/care-taker related. **The decision not to operate is not equivalent to denial of care;** rather, it gives the clinicians, patients and relatives, the opportunity to re-evaluate the goals of care, motivation and expectations, and thus enhance the outcome of the reconstruction.
**Aggressive surgery** is contraindicated in patients placed under palliative care in which the main goal is comfort, and the **following may be considered relative contraindications:**

1. Acutely injured patients who develop pressure ulcers in the first two months post trauma – most of these are in the process of dealing with the stress of status change – from an independent, mobile ‘bread winner’, to a dependent, compounded by the physical disability.
2. Depressed patients: these are often uncooperative, or unable to perform basic self-care.
3. Patients whose relatives/guardians are unavailable or unwilling to provide supportive care at home.
4. Patients who are yet to learn basic self-care tasks including bed to chair transfers, and turning.
5. Patients who have no reason to get better, no goals in life.

However, while patient support (both financial and family) may be poor or inadequate, patient motivation, goals in life, and demonstrated level of self-care may be sufficient to justify an aggressive surgical approach, with the goal of further improving the patient’s degree of independence, self-image and social acceptability.

**Tips**

1. The patient must be able and willing to lie prone – patients who object will usually be uncooperative, and it is best to hold off surgical intervention until the patient is willing and able to lie prone. This is a position that the patient will ideally rest in for the most part of the three months following surgical reconstruction. Patients who follow this regimen tend to have few recurrences. Care-takers/parents must likewise be willing to ensure child/patient positioning.
2. Dressing changes should be done with each bowel movement, to avoid soiling of incisions, leading to infection and wound breakdown.
3. If possible to measure, serum albumin levels should ideally be above 2.5 g/dL to ensure optimal wound healing.
4. Nutritional support with a local diet that ensures delivery of a high protein diet is essential for optimal wound healing.

**Goals of surgical pressure ulcer therapy**

1. Reduction of protein loss through the wound,
2. Prevention of progressive osteomyelitis and sepsis,
3. Avoidance of progressive secondary amyloidosis and renal failure,
4. Improvement of patient hygiene and appearance,
5. Avert future Marjolin’s ulcer,
6. Lowering of the cost of rehabilitation
7. To aid nursing.

Aggressive efforts at adequate nutrition, infection control, physical therapy and surgery are warranted in patients with potentially reversible underlying causes of pressure ulcers. In chronically ill or palliative care patients however, the goal of care is the provision of comfort only.

**The principles underlying pressure ulcer surgical excision**, established by Conway and Griffith in 1956, have not changed, and remain pertinent to date; these include:

1. The excision of the ulcer and surrounding scar, underlying bursa, and soft tissue (heterotopic) calcification, if any;
2. Radical removal of the underlying bone;
3. Padding of bone stumps, filling the dead space with fascia or muscle flaps;
4. Resurfacing defect with large regional pedicled flap and
5. Grafting the donor site of the flap with thick split skin, if needed.

**Surgical technique**

Under general anesthesia, the patient is first catheterized, and then turned prone. After draping the patient, the ulcer(s) is then painted with gentian violet, and the ulcer excised, along the principles outlined by Conway and Griffith. After surgical preparation, the wound is painted with sterile gentian violet solution (cheaper, and more readily available in Kenya than methylene blue), to map out the ulcer margins along with any associated bursae and sinuses. A 3% hydrogen peroxide solution may be used to wash off excess gentian violet. The ulcer, surrounding scar and any heterotopic bone are then excised with a small cuff of normal tissue. An excision less than this will likely lead to a wound infection and dehiscence. Bone that is either prominent or infected should be excised, and smoothed out, while ensuring that the ostectomy does not lead to an imbalance between the two sides, which would lead to increased pressures and pressure ulcers on the contralateral side. The bone should then be padded with a muscle flap, and any dead space filled with tissue, which also allows skin resurfacing, using a flap.

**Common post-operative complications** include hematomas, infections, wound dehiscence, recurrence and heterotopic ossification of muscle flaps.
Independence, social acceptance, freedom from discomfort and a feeling of adequacy have been identified as the most important desires of patients with SCI. A causal relationship between pressure ulcer development and a combination of both environmental/extrinsic (pressure, shear, and frictional forces) and systemic/intrinsic (neurological impairment, age, weight, moisture (fecal/urinary incontinence) factors is accepted. The recognition that pressure ulcer development is a very complex process has led to the formulation of a number of theories over the years, including:

1. The prevention of pressure ulcers is better than their cure
2. Basic skin care and adequate pressure dispersion are the primary tenets of prevention.
3. The burden, both social and financial, that spinal cord injuries place on sub-Saharan economies is enormous.
4. Patients with SCI face an even greater task in this environment. Since rehabilitation is largely unavailable; since there is the shift from independence to a dependency on others and
5. Because these patients lack the necessary tools to adjust to a completely new and physically irreversible social status,
6. Therefore many slide into depression. The social, healthcare and transport infrastructure in most of sub-Saharan Africa is poorly adjusted to the physically challenged. With little or no government support, the family is forced to take financial responsibility over the care of the SCI patients.

**Table 2: Traditional flaps for given pressure ulcers:**

<table>
<thead>
<tr>
<th>Pressure ulcer</th>
<th>Primary option</th>
<th>Secondary option</th>
<th>Tertiary option</th>
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<tbody>
<tr>
<td>Ischial ulcer</td>
<td>Inferior Gluteus Maximus Island Flap</td>
<td>Inferior Gluteal Thigh Flap</td>
<td>V-Y Hamstring Flap</td>
</tr>
<tr>
<td>Sacral ulcer</td>
<td>Y-V Gluteus Maximus Flap</td>
<td>Buttocks rotation flap (fasciocutaneous)</td>
<td></td>
</tr>
<tr>
<td>Trochanteric ulcer</td>
<td>TFL</td>
<td>Vastus Lateralis Muscle</td>
<td></td>
</tr>
<tr>
<td>Heel Ulcer</td>
<td>Medial Plantar Flap</td>
<td>Delayed Reverse Sural Artery Flap</td>
<td>Cross Leg Flap</td>
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**Clinical Cases**
1. PL 30 year-old male, father of 4, cobbler by profession. Spinal cord injury 12 years prior to current admission. Two previous admissions elsewhere for pressure ulcer care. Motivated, supporting own family, but wheelchair bound. After discussion, and understanding of the process of treatment, wound excised and closed with a local flap. See table

2. FL 4 year-old girl with spina bifida and hydrocephalus. Ventriculoperitoneal shunt placed at age 4 months. Child left with other children to permit mother to go out and work. She developed bilateral trochanteric pressure ulcers, with septic hip joint arthritis and chronic osteomyelitis of both heads/necks of femur. Initial evaluation showed an albumin 1.4 g/dL. Wound debridement and nutritional support provided, albumin levels raised to 2.5 g/dL. Discharged home for further nutritional support and wound care, pending definitive treatment. Review at 1 month, child malnourished, wounds infected, and albumin 1.5 g/dL. Child re-admitted for nutritional support. Upon attainment of 3.0 g/dL, right Girdlestone and left débridement, with right tensor fascia lata flap. Left wound closed by secondary intention. Subsequent visits, child healthy, wounds completely healed. See figures 4-7 below.
Fig 4-7 Trochanteric ulcer, bilateral—treated with soft tissue débridement, bilateral ostectomy with right side Girdlestone and left side bony débridement only and TFL flaps (Girdlestone procedure—removal of hip and trochanter)

3. Large chronic sacral ulcer secondary to irradiation. Debridement and large Transverse back flaps with small hamstring flap to cover left side. Small breakdown on right side was treated with another hamstring flap. Figures 8-11
Large sacral pressure ulcer was secondary to irradiation. Wide débridement and closure with large transverse back flaps which are perforator flaps was done in one stage.

(Editor's Summary: This is an excellent chapter with very specific guidelines for performing pressure sore, decubitus ulcer surgery anywhere in the world. Vacuum Assisted Closure (VAC) may be used if available to help prepare wounds for closure by flaps or skin grafts. In most cases flaps will not be sensate. Therefore, patients must be warned of this preoperatively so that they can continue diligent care of these areas postop.)