

# Clinical features and management of pressure ulcers for the general surgeon

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## Abstract

Although widely considered to be preventable, pressure ulcers (PU) are common and cause a significant burden to the individual, their carers and healthcare services. International collaborative panels publish consensus documents and guidelines aiming to standardize PU classification, assessment and management. There is a huge emphasis on prevention, which requires awareness and education for clinicians, patients and carers. Surgeons may be referred patients with PU for advice on surgical options or management of infected wounds. Surgical patients may develop PU after prolonged surgical procedures, during periods of critical illness or in association with their surgical condition. Additionally, as some PU become chronic and non-healing, individuals with PU may be referred for assessment of other medical issues. An awareness and understanding of PU aetiology, management strategies and complications are therefore important for the surgical trainee.

**Keywords** Pressure injuries; pressure sores; pressure ulcers; wound healing; wound infection

## Introduction

A pressure ulcer (PU) is a soft tissue injury caused by pressure over a bony prominence resulting in ischaemia, cell death and tissue necrosis. Incidence and prevalence data vary in the literature depending on the care setting (for example home versus nursing home versus acute hospital). In the United Kingdom, an estimated 4–10% of people admitted to hospital develop new PU, with an increased risk of death in some groups.<sup>1</sup> Daily treatment costs have been estimated at £43 to £374 (2011 prices) depending on PU severity, and hospital-acquired PU result in up to 4800 excess bed days annually.<sup>2</sup> Individuals with PU may also experience reduced quality of life, pain and complications such as infection and osteomyelitis. Many PU are considered preventable, but factors such as patient choice and terminal illness can impede implementation of prevention strategies.

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## Clinical features

Pressure ulcers are commonly encountered in elderly patients with comorbidities, particularly when they are admitted to hospital or are in long-term care facilities. Other at-risk groups are those with neurological disorders such as spinal cord injury, stroke and multiple sclerosis. Tissue injury occurs over hard bony prominences or can be associated with medical devices such as tubing, casts or neck collars. The visible external damage ranges from superficial redness to extensive, necrotic wounds involving bone. Locations most frequently affected are the sacrum, ischium, trochanter, calcaneum, occiput and olecranon (Figures 1 and 2).

It is usually relatively easy to diagnose PU due to the history of immobility, prolonged pressure over the common sites noted above and patient comorbidities such as neurological impairment or advanced age. However, there are several other disorders which may have overlapping clinical features as indicated in Table 1.

## Classification

The international classification system developed by the National Pressure Injury Advisory Panel (NPIAP), the European Pressure Ulcer Advisory Panel (EPUAP) and the Pan Pacific Pressure Injury Alliance (PPPIA) is commonly used.<sup>3,4</sup> Categories I to IV are classified according to the tissue type visible or palpable in the wound base (Figure 3). There are also two categories where the depth is unknown, unstageable, where full thickness tissue loss is covered by slough or eschar, preventing classification until it has been removed, and suspected deep tissue injury, where there is purple or maroon discolouration of intact skin or a blood-filled blister due to damage to the underlying soft tissue. The depth of PU categories varies depending on location – a category III or IV ulcer can be shallow where there is little subcutaneous fat, e.g. the bridge of the nose or occiput.

## Pathogenesis

The development of pressure damage depends on the mechanical load applied to the tissue combined with its ability to withstand that load (tolerance).<sup>5</sup> The mechanical load can be perpendicular (pressure) or parallel (shear) to the skin. Tolerance to mechanical loads depends on anatomy, tissue morphology and repair capacity which may be influenced by age, disease, temperature and moisture. A mechanical load resulting from bodyweight against a surface (bed/chair) or a device against the skin leads to tissue deformation around the site of contact. Sustained tissue deformation can directly damage cells or cause ischaemia by occlusion of blood vessels. Different tissue types have differing susceptibility to ischaemia, with muscle at higher risk than the overlying skin. This explains how muscle damage can occur despite skin remaining intact.

## Risk factors

Immobility, for any reason, is probably the most important risk factor for PU occurrence. This may be due to sedation, paralysis, trauma, frailty and even abuse or neglect. If the patient has impaired sensation of any cause, for example spinal cord injury, chronic neurological disorders or a peripheral neuropathy,



**Figure 1** Common sites for pressure ulcers. Top left, ischial tuberosity; top right, greater trochanter; bottom left, elbow; bottom right, sacrum.

responses to noxious stimuli are disrupted and external pressure goes unnoticed. Age is a significant risk factor and the majority with PU are over 70 years of age. Comorbidities such as diabetes, vascular and respiratory disease can also increase risk. Moist skin is more susceptible and therefore faecal and urinary incontinence are considered risk factors. In the situation of critical illness, severe haemodynamic instability and a catabolic state can lead to faster development of tissue ischaemia.

### Assessment

Other than determining PU severity using the classification system described, assessment of the general health of the individual and of the wound itself are also required to optimize conditions for healing. The aim is to identify and correct (where possible) any factors that can delay wound healing. Examples of local factors include the presence of necrotic tissue, infection and excessive moisture. Systemic factors include hypoxia or hypovolaemia, poor glycaemic control and malnutrition. Wound infections are diagnosed clinically and not based on wound swab results. The obvious signs of infection are warmth and erythema surrounding the wound. Other signs include malodour, unhealthy or friable granulation tissue and purulent exudate. The more dramatic presentation of crepitus should make the surgeon consider urgent debridement of the wound due to the possibility of necrotizing fasciitis.

### Prevention

Prevention requires the performance of a thorough risk assessment, usually completed by nursing staff. A variety of tools aid stratification of risk and therefore implementation of appropriate preventative strategies. For example, a patient with a spinal cord injury admitted to hospital with sepsis would be high risk and

require immediate preventative strategies such as a repositioning regime and a specialized bed or mattress. There is some evidence that repositioning every 2–3 hours rather than every 4–6 hours is associated with lower risk of PU development, as is the use of ‘turning teams’.<sup>6</sup> Maintaining skin hygiene and hydration and using barrier preparations for moist areas are also important. Prophylactic use of dressings can be helpful for localized high-risk areas, such as the heels or malleoli.



**Figure 2** Multiple deep pressure ulcers in an individual with spinal cord injury living in the community.

**Differential diagnosis of pressure ulcers**

<b>Incontinence-associated dermatitis</b>	Urinary or faecal incontinence leading to skin inflammation and breakdown in the genital areas, inner thighs and buttocks Commonly confused with pressure ulcers but increases the susceptibility to pressure damage, so may occur concurrently
<b>Pilonidal sinus</b>	Usually in young, fit patients without any risk factors for pressure damage Typical pits may be seen in the natal cleft
<b>Diabetic foot ulcer</b>	Neuropathic ulcers tend to occur over pressure points such as the metatarsal heads or heels, whereas neuroischaemic ulcers more frequently affect the margins of the foot or tips of the toes Often occur in those with poor glycaemic control

Table 1

**Management**

**General considerations**

Management (particularly of more severe ulcers) usually requires a multidisciplinary approach (Figure 4). Tissue viability nurse input should be sought early. Therapies input ranging from physiotherapy and occupational therapy to orthotists and clinical engineers may be needed for patients with complex needs. Clinical photography and incident reporting are usually required and should be carried out according to local policy. Risk factors should be identified and corrected wherever possible. Optimization of nutrition is considered a key step, and severe PU can be associated with an additional caloric requirement. Dietician involvement is therefore essential.<sup>7</sup> Pain within these lesions is an often understated entity and analgesia may be needed, particularly for dressing changes. The most superficial ulcers can be treated with simple analgesia, local wound care and pressure redistribution.

**Pressure redistribution**

Offloading the damaged area by repositioning and pressure redistribution is the cornerstone of treatment and prevention of further injury. Pressure mapping can be useful but is generally reserved for complex cases that have not responded to standard measures. Regular repositioning may be done by

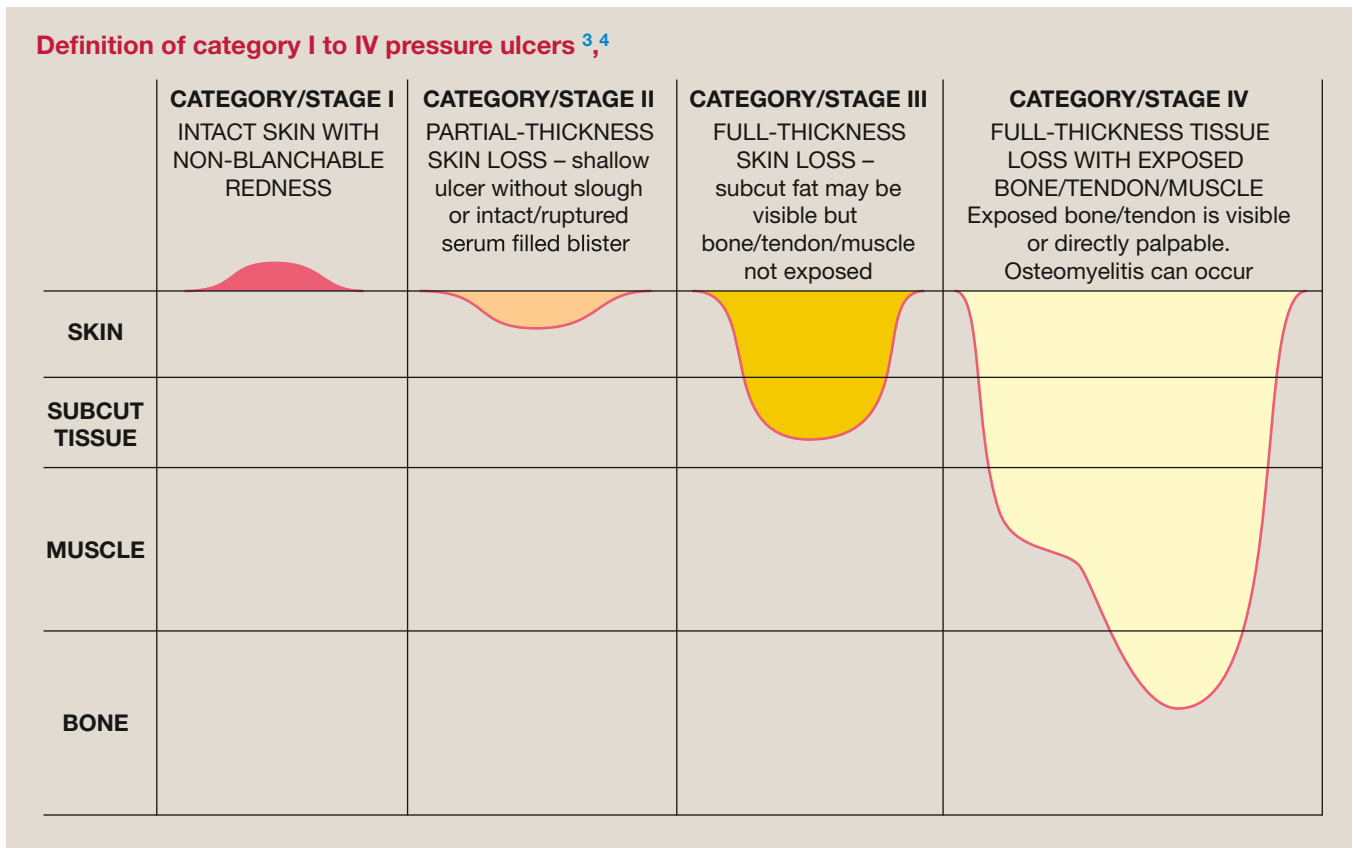


Figure 3

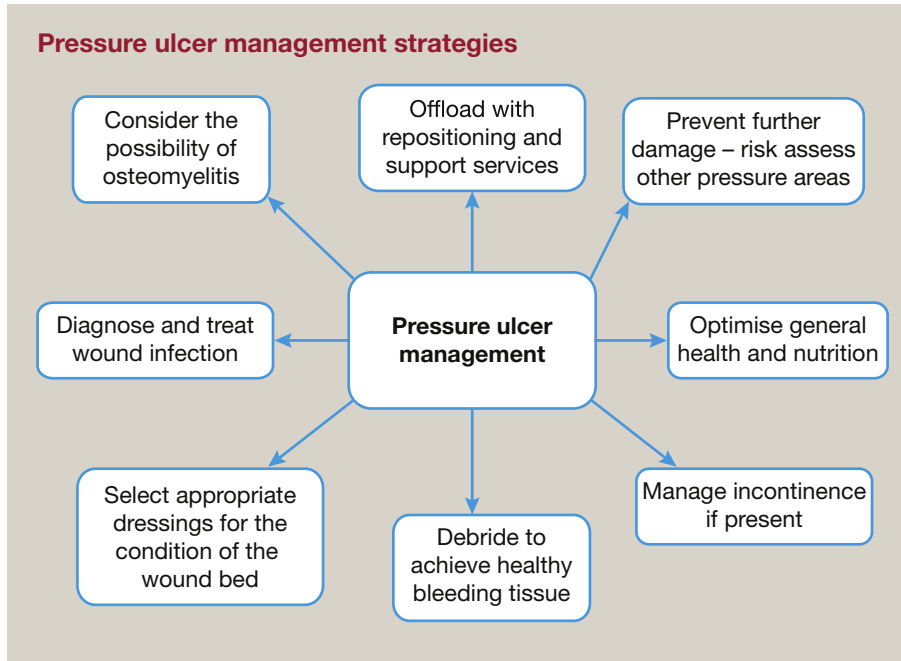


Figure 4

the patient (if mobile) or by healthcare staff and aims to off-load pressure areas (bony prominences and existing PU). Support surfaces such as specialized beds, mattresses or cushions are used in prevention and treatment. Medical devices should be removed where possible but regularly repositioning the device or using a physical support (e.g. thigh strap for urinary catheter) can help reduce damage. Those with prosthetic limbs should avoid using them until healing is

achieved and may need to be reassessed as to the ability of the limb to fit after recovery has taken place.

**Dressings**

The choice of dressings is vast, but there is no robust evidence for the superiority of any particular type in treating PU.<sup>8</sup> Selection will depend on the characteristics of the wound such as moisture level, presence of slough or necrosis, bioburden, depth and



Figure 5 Pressure ulcers that may need surgical intervention. Top left, an unstageable pressure ulcer covered by eschar. Bottom left, a pressure ulcer with undermining, demonstrated by the probe. Right, a deep pressure ulcer with bone exposure.

location. Absorbent dressings such as foams or alginates should be used for wounds with high exudate levels. Hydrogel dressings can be used to donate moisture to dry wound beds or to help facilitate autolytic debridement. Hydrocolloid dressings are useful for granulating, superficial PU.

### Negative pressure wound therapy (NPWT)

The use of NPWT for healing acute and chronic wounds was first reported in 1997.<sup>9</sup> It works by improving blood supply, removing exudate, reducing swelling and reducing bacterial count within the wound.<sup>10</sup> Its use has become widespread; however, a 2015 Cochrane review concluded that there was no randomized control data available regarding the effects of NPWT compared to alternatives for managing PU.<sup>11</sup>

### Debridement

The aim of debridement is to remove all necrotic and devitalized tissue to create a wound bed with healthy granulation tissue. The exception is dry, adherent eschar without fluctuance or erythema on the heels, which has a protective effect and should be left in situ for fear of creating an open wound. The quickest and most effective way to remove all unhealthy tissue is in the operating theatre. Once bleeding tissue has been seen, it is likely further debridement is unnecessary. In practice, many patients with PU have high anaesthetic risk and hence spinal or regional nerve blocks may allow avoidance of general anaesthetic. Alternative debridement methods such as sharp debridement at the bedside, use of larvae or autolytic debridement (creating a moist environment to facilitate endogenous enzymes) may be more suitable. Whichever method is used, optimization of the wound bed is key for adequate wound healing.

### Surgery

Category III and IV PU may have undermining, tunnelling and sinus formation, so are more likely to require surgical intervention. Following debridement, small wounds may heal spontaneously while larger ones may require additional procedures such as skin grafts or composite flaps. It is vital that optimization of all factors contributing to pressure damage has taken place before consideration of reconstructive surgery. Even with flap coverage there is a recurrence rate, particularly in those with a spinal cord injury who may require further flap surgery in the future.<sup>12</sup> Options for flap reconstruction include musculocutaneous, fasciocutaneous and perforator-based flaps, but there is little evidence for any difference in complications or recurrence rates between them.<sup>13</sup> Consideration must be given to the individual circumstances, including (but not limited to) comorbidities, wound location, presence of osteomyelitis, risk of recurrence and patient choice. In the case of sacral PU, a vascularized muscle flap provides bulk, which eliminates dead space within the wound and can resist shear and pressure forces. For PU on the buttocks or sacral area, a defunctioning colostomy may be useful in selected cases. Similarly, permanent urinary diversion can be performed by suprapubic catheter insertion for management of urinary incontinence. Examples of pressure ulcers that may need surgical intervention are shown in Figure 5.

## Complications

### Wound infection

Typically, a wound with slough and necrotic tissue will contain multiple bacteria. This invariably consists of *Staphylococcus aureus*, *Pseudomonas aeruginosa*, group D *Streptococcus*, *Proteus* and *Bacteroides* species. The knee jerk use of antibiotics without evidence of systemic infection must be limited as this practice is usually unnecessary. However, those that are immunocompromised or have extensive open wounds should be treated in a timely fashion. Localized wound infection can be managed with debridement, antiseptic agents and dressings. Antibiotics are needed when there are signs of systemic infection such as cellulitis or sepsis. Wound cultures (ideally from a tissue sample rather than a swab) should be used to guide antibiotic choice.

### Osteomyelitis

Osteomyelitis should be considered in wounds with exposed bone or when standard treatment methods are failing. A plain X-ray may add useful information, but a normal appearance does not rule out osteomyelitis. Magnetic resonance imaging is preferable but the optimum investigation is a bone biopsy whereby a clean sample of the bone (not obtained through the wound itself) can be cultured to demonstrate the presence of bone infection and the causative organism. The use of antibiotics for proven osteomyelitis remains controversial as bone debridement and coverage with a vascularized flap appears the optimum treatment for this condition. NPWT should be avoided when there is osteomyelitis with exposed bone in the wound base. In some cases, osteomyelitis becomes chronic and this invariably leads to a non-healing wound. Those that cannot undergo bone debridement may need long-term antibiotics to prevent systemic illness.

## Conclusion

Pressure ulcers result in significant morbidity for patients and are costly for healthcare providers. Most PU are superficial and will heal with the basic management strategies of pressure redistribution, skin care and appropriate dressings. However deeper ulcers may require surgical intervention in the form of debridement and reconstruction. Identification and correction of barriers to healing are essential for good outcomes. With an ageing population, there will be more individuals at risk of pressure damage and the importance of PU prevention cannot be over-emphasized. ◆

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### Practice points

- Pressure ulcers are common in patients admitted to hospital and in long-term care settings
- They most commonly occur over bony prominences but can also be associated with medical devices
- The presentation can vary from superficial lesions to extensive wounds with bony involvement
- Prevention of PU is key; this is achieved by risk assessment and preventative strategies such as regular repositioning and use of support surfaces
- Management requires pressure redistribution and optimization of local and systemic factors for healing; this includes ensuring adequate nutrition, thorough wound debridement and treatment of wound infection