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Pressure ulcers: an overview

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Abstract

This article gives a general overview of pressure ulcers, with a focus on secondary care. Pressure ulcers are damage to the skin or underlying tissue as a result of pressure, friction or shearing forces. They place a significant physical, psychological and financial burden on patients and healthcare systems which will be explored. This review also covers risk assessment, classification and management of pressure ulcers in the inpatient setting.

Key words: Cellulitis; Pressure ulcer; Risk factors; Ulcer; Wound Healing

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Introduction

Pressure ulcers generally occur as a result of unrelieved pressure over bony prominences causing damage to the skin and the underlying tissue. These can occur in any patient but are more common in those with certain risk factors. They have a significant physical, psychological and financial impact on patients and healthcare systems.

This article covers the aetiology, epidemiology, clinical features, investigation and management of pressure ulcers, including the need for a tailored multidisciplinary team approach.

Definition

Pressure ulcers have historically been described using many terms including 'decubitus ulcers', 'pressure sores' and 'bed sores'. In many countries the term 'pressure injury' has been adopted to reflect the inclusion of deep tissue injuries within the classification system (National Pressure Ulcer Advisory Panel et al, 2014). However, in the UK, as per the guidelines of the National Pressure Ulcer Advisory Panel and the European Pressure Ulcer Advisory Panel, set up in 1997 to improve the recognition and management of pressure-related skin damage, the term 'pressure ulcer' should be used (NHS Improvement, 2018).

A pressure ulcer is localised damage to the skin and/or underlying tissue, usually over a bony prominence, resulting from sustained pressure (including pressure associated with shearing forces). The damage can be present as intact skin or an open ulcer and may be painful (Kane et al, 2013). A pressure ulcer developed as a result of the use of a medical device, for example following the use of oxygen delivery sets, should be labelled distinctly as a 'medical device-related pressure ulcer' (National Pressure Ulcer Advisory Panel et al, 2014).

Pressure ulcers are not to be confused with another type of skin lesion called a moisture lesion. Moisture lesions usually develop around the buttocks or in skin creases, such as under the breasts or in the groin. These lesions by definition need to be associated with moisture, so are often associated with incontinence. The presence of moisture between opposing skin surfaces leads to a much more diffuse area of dermatitis, often with distinctive 'kissing lesions', where the pattern of dermatitis is the same on both skin surfaces (National Institute for Health and Care Excellence, 2014). The distinction is important as, while pressure ulcers and moisture lesions can co-exist, their treatments are significantly different. It is also worth noting that venous and arterial ulcers have separate definitions and, while their assessment and management is outside the scope of this article, they may co-exist with pressure ulcers.

Health and economic impact

NHS Improvement (2018) found that, between April 2015 and March 2016, 24 674 new pressure ulcers were diagnosed, with a resulting cost to the NHS of more than £3.8 million

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per day. Pressure ulcers can cause a prolonged hospital stay. Theisen et al (2012) found that patients aged over 75 years who developed a pressure ulcer in hospital stayed on average 10 days longer than those who did not.

Moreover, pressure ulcers represented nearly a fifth (19%) of all severe patient safety incidents that were reported to the National Reporting and Learning System in 2011–12 (National Institute for Health and Care Excellence, 2014).

How they develop

A pressure ulcer is formed when an area of skin and the underlying tissues are damaged as a result of being placed under pressure sufficient to impair blood supply. Three main mechanisms contribute to pressure ulcer formation: pressure, shearing forces and friction (Mervis and Phillips, 2019a).

Pressure ulcers tend to develop over the bony prominences that are under most pressure (Figure 1). If a patient is confined to their bed, these areas tend to be the sacrum, coccyx, trochanter and the calcaneus, whereas if a patient has prolonged periods of sitting in a chair then the coccyx and elbows are potentially at higher risk.

Continued external pressure greater than the pressure in the capillary bed will cause a reduction in blood supply to the underlying tissue. In turn, this will lead to hypoxia and eventually necrosis within the tissue. The amount of pressure or time required to cause a pressure ulcer will vary depending on the quality of tissue and blood supply. For example, patients with already impaired blood supply, such as those with peripheral vascular disease, will require less overall pressure or a shorter period of time to develop pressure ulcers (Mervis and Phillips, 2019b).

Pressure ulcers often demonstrate the 'tip of the iceberg' effect, where the skin surface is relatively spared compared to the underlying tissue. This is because necrosis often starts at the site of the highest pressure which is at the bone and muscle interface. Moreover, as muscle has the highest metabolic rate, the risk of hypoxia and necrosis peaks at the bone/muscle interface. Consequently, a pressure ulcer may be much more severe than first thought because the damage at the deeper tissues is not reflected at the surface.

Skin rubbing against a material such as clothing or bedding causes friction which may initiate a break in the epidermis, and repeated friction can lead to deeper injury. Shearing forces refer to two surfaces moving in the opposite direction. An example of this in hospital is when the head end of the bed is elevated and the patient may slide down the bed. This forceful inter-tissue plane movement causes tearing of blood vessels, resulting in reduced blood flow or even necrosis to that tissue.

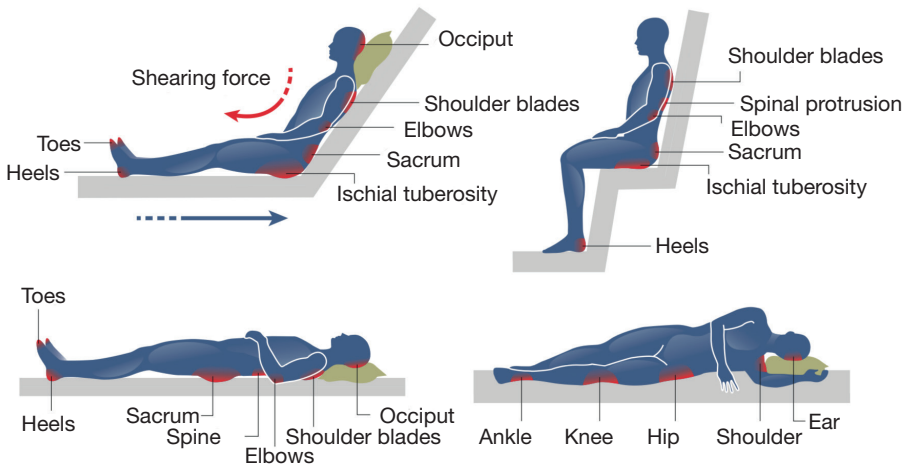

Figure 1. Common sites of pressure ulcers. From Best Practice Statement (2012).

Table 1. Key risk factors for developing a pressure ulcer

Risk factor	Examples
Cognitive impairment	Dementia, delirium
Decreased mobility	Spinal injury, recent surgery, stroke, sedated patient
Decreased sensation	Diabetes, neuropathy, multiple sclerosis
Elderly	Comorbidities and natural skin ageing
Malnutrition	Anorexia, cancer
Medication	Cytotoxics, long-term steroids
Moisture	Incontinence
Previous pressure ulcer	

Risk assessment

Some patients are at higher risk of pressure ulcer formation, for example those with reduced mobility, decreased sensation, nutritional deficiency, cognitive impairment or a history of pressure ulcers (Table 1). Patients who are not able to reposition themselves are also high risk, meaning that all patients who are critically unwell in hospital are at risk. The National Institute for Health and Care Excellence (2014) states that patients should have a pressure ulcer risk assessment undertaken on admission to secondary care or a care home. The Waterlow chart (http://www.judy-waterlow.co.uk/the-waterlow-score-card.htm) is one of the most commonly used risk assessment tools in the NHS.

Other risk assessment tools suggested by National Institute for Health and Care Excellence include the Braden scale and Norton risk assessment. Risk assessment tools should always be used alongside clinical judgement (National Institute for Health and Care Excellence, 2014).

As with all conditions, prevention is better than the cure. Patients judged as being at risk of pressure ulcers should change position every 6 hours, but if they are in the high-risk category this should be every 4 hours. Patients unable to reposition themselves should be offered help in doing so, with the appropriate equipment if required. Patients admitted to secondary care should be offered a high specification foam mattress and pressure-relieving cushion if they will be sitting for significant lengths of time (National Institute for Health and Care Excellence, 2014).

Staging of pressure ulcers

Accurate staging of pressure ulcers is not only important to ensure the correct management, but also to ensure the correct monitoring for healing or deterioration. Classification or staging of pressure ulcers comes from the International National Pressure Ulcer Advisory Panel/European Pressure Ulcer Advisory Panel pressure ulcer classification system, based on the work by Edsberg et al (2016) (Figure 2).

Treatment of pressure ulcers

Treatment of pressure ulcers is multifactorial and will include education, patient optimisation (Table 2) and correcting any reversible causes (Table 3).

Education

Education is important not only for medical staff but also for patients or carers, who should be made aware of the role they can play in prevention and treatment. They should also be informed of the management plan to treat an ulcer should one develop and hopefully agree with it.

Patient optimisation

Optimisation aims to promote the best conditions to allow ulcer healing.

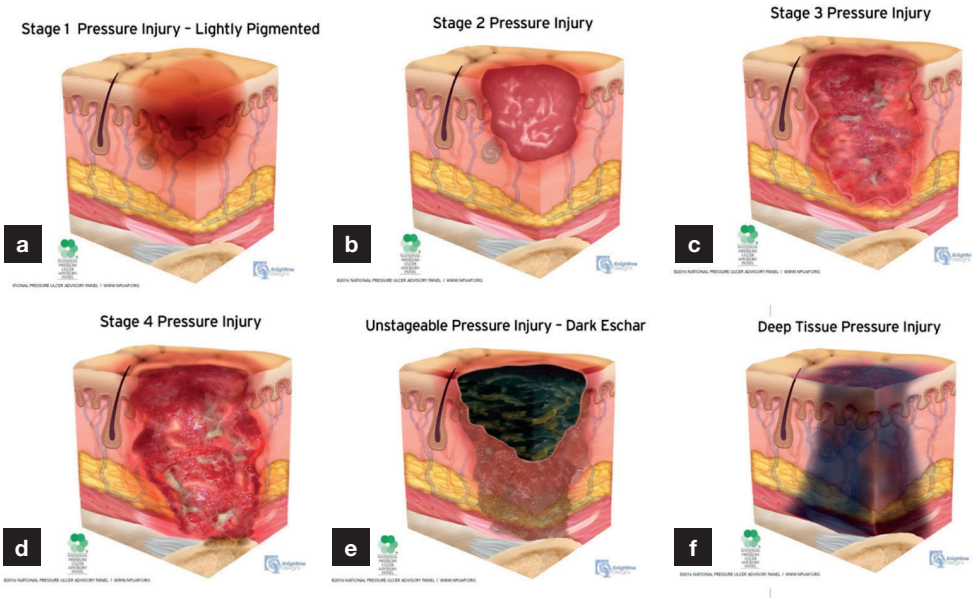

Figure 2. Classification of pressure ulcers using the International National Pressure Ulcer Advisory Panel/European Pressure Ulcer Advisory Panel pressure ulcer classification system (https://npiap.com/page/PressureInjuryStages). a. Stage 1 (non-blanchable erythema). Skin is intact with non-blanchable redness localised to an area usually over bony prominence. Area may be painful, firm, soft, warmer or cooler than adjacent tissue. b. Stage 2 (partial thickness skin loss). Partial thickness loss of dermis presenting as a shallow ulcer with a pink wound bed. c. Stage 3 (full thickness skin loss). Ulcer in which subcutaneous fat may be visible with or without slough. However, bone, tendon or muscle are not visible. d. Stage 4 (full thickness tissue loss). Ulcer in which muscle, tendon or bone is exposed. Depth of the ulcer will vary depending on anatomical location. Ulcer often includes undermining or tunnelling, hence is at risk of causing osteomyelitis. e. Unstageable (depth unknown). Ulcer in which base is covered by slough or necrotic tissue therefore true depth cannot be determined, and therefore classified. f. Deep tissue injury presents with a purple or maroon localised area of discoloured skin or blood blister as a result of damage of underlying soft tissue. In darker skin types it may be difficult to detect whether non-blanching skin erythema is present, such as in stage 1 ulcers or a deep tissue injury, so high suspicion of risk is required.

Table 2. Patient optimisation	
Pressure relief	Twice-hourly repositioning
	Correct surface
Adequate nutrition and hydration	
Pain relief	
Reduce moisture	
Increase mobility	

Table 3. Addressing reversible causes
Treat acute illness
Good diabetic control
Correct anaemia
Correct incontinence issues
Antibiotics if cellulitis, systemic infection or osteomyelitis
Ensure adequate blood supply

Although poor nutrition is a risk factor for developing pressure ulcers, supplements should not be empirically offered. Patients should have a nutritional assessment undertaken by a dietician and then be given supplements if necessary (National Institute for Health and Care Excellence, 2014).

All patients with a pressure ulcer should be given a high-specification foam mattress to help redistribute pressure. A Cochrane review by McInnes et al (2015) showed a decrease in pressure ulcer incidence with the use of a high-specification foam mattress compared to use of standard hospital mattresses with a risk ratio of 0.4. If this does not suffice then a dynamic support surface should be used.

Addressing reversible causes

Reversible causes include any condition that has contributed to the ulcer development but also prevents healing. For example, a heel pressure ulcer may develop in the context of peripheral vascular disease. Therefore, albeit rarely in non-healing ulcers, re-vascularisation may be considered but only after a careful multidisciplinary team approach to select the appropriate patient.

Topical antibiotics should not be routinely used. Systemic antibiotics should only be given when there is evidence of spreading cellulitis, osteomyelitis or sepsis (National Institute for Health and Care Excellence, 2014).

When to refer a patient to the tissue viability team will depend on local trust policy. Generally, any deteriorating pressure ulcer should be referred, and any stage 3 or 4 ulcer should trigger a referral. A new stage 3 or 4 ulcer will often trigger a root cause analysis by the senior nurse on the ward.

Ulcer management

Management of the ulcer itself will depend not just upon staging but careful ulcer assessment, of which there are many components (Table 4). This thorough wound assessment then allows for a tailored treatment plan. Table 5 summarises management.

There are numerous types of dressings available (Table 6), but selection will depend upon assessment of the ulcer. Generally for non-exudative wounds, hydrocolloid or hydrogels are commonly used (Westby et al, 2017), whereas exudative wounds require moist to absorbent types, such as hydrogel or alginate dressings.

Vacuum therapy or topical negative pressure therapy is not routinely used, but can be a useful option for ulcers with high levels of exudate requiring multiple dressing changes a day (Vowden and Vowden, 2002).

Debridement should be considered where necrotic tissue is present and healing would be delayed. Debridement may involve sharp debridement, autolytic or enzymatic, or maggot larvae therapy (Vowden and Vowden, 2002). If there is concern regarding wound or systemic infection, then sharp debridement should be first line.

If osteomyelitis is suspected, particularly in stage 4 ulcers, then imaging should be obtained starting with an X-ray. However, an X-ray may not detect osteomyelitis in

Table 4. Assessment of pressure ulcers

Location of ulcer
Size and depth
Amount of exudate
Presence of infection
Presence of necrotic tissue
Odour
Pain
Staging of ulcer
Any precipitating cause

Table 5. Management of pressure ulcers	
Pressure relief	■ Pressure-relieving mattress: high specification foam or dynamic support ■ Minimum 2-hourly repositioning
Nutritional and medical optimisation	■ Supplements if intake is inadequate ■ Adequate hydration ■ Correcting any reversible factors
Infection	■ Antibiotics only if evidence of cellulitis or systemic infection ■ Assess for osteomyelitis
Contamination control	■ Significant issues with urinary incontinence may require urinary catheter ■ Bowel care: a flexi-seal can be an option but for definitive control a diverting colostomy may be an option. This would only be appropriate for certain cases, such as those undergoing reconstructive surgery, and would require general surgical input for colostomy assessment
Debridement	■ If necrotic tissue and infection are present sharp debridement should be undertaken as first line ■ Other options are autolytic or maggot larvae therapy
Dressing choice	■ Will depend on assessment of the ulcer – more detailed summary in Table 6

the first instance, so if suspicion is high a magnetic resonance imaging scan should be ordered. If osteomyelitis is confirmed, then orthopaedic input would be required for further management as well as referral to the bone infection multidisciplinary team if such a service is available.

Surgery can be an option in carefully selected patients with non-healing ulcers where fully optimised conservative management has failed. Suitability for surgery would depend on probability of recurrence, cognition, motivation of patient, pre-existing comorbidities and overall 'fitness' for surgery and anaesthesia (Wong et al, 2016). The National Institute for Health and Care Excellence does not currently recommend a specific type of surgery, although commonly it would involve a local or regional flap procedure. However, further details regarding the types of surgical procedure are beyond the scope of this article.

Careful monitoring is required on the progress of any pressure ulcer. The Pressure Ulcer Scale for Healing measures the size of ulcer, the amount of exudate and the tissue type over time. It was validated by Gardner et al (2005) and is now a well-recognised tool for monitoring, recommended by the European Pressure Ulcer Advisory Panel in 2014.

Complications

If not appropriately treated then pressure ulcers can cause several complications and can be life threatening. Cellulitis is a common infection that can occur in the surrounding skin; however, infection from a pressure ulcer can spread into underlying joints or bones causing septic arthritis or osteomyelitis (Allman, 1997). On occasions these infections from pressure ulcers will lead to sepsis requiring hospital admission and intravenous antibiotics, therefore becoming potentially life threatening (National Institute for Health and Care Excellence, 2014).

Additionally, in the long term, non-healing wounds can develop into a form of squamous cell carcinoma, known as Marjolin's ulcers (Trent and Kirsner, 2003).

Conclusions

Pressure ulcers place a significant burden on not only patients, but also healthcare systems, so it is important that the focus should be on risk assessment and prevention. However, when pressure ulcers do arise, generally speaking, they occur as a result of unrelieved pressure over bony prominences, thus are more common at certain sites on the body, and are more common in patients with certain risk factors. Management relies on an accurate multi-component assessment to allow a tailored treatment plan to be created for that patient,

Table 6. Wound dressings' properties by category

Dressing	Appearance	Uses	Advantages	Disadvantages	Absorbency	Examples
Gauze	Woven tissue	An absorbent secondary dressing for exudating or oozing wounds	Highly absorbent. Cheap	Desiccating and adherent	High	Gauze
Semi-permeable polyurethane film	Transparent film	For small, minimally exudative wounds as a primary dressing. As a secondary dressing for other wounds	Allows monitoring of skin. Conformable. Cheap	Fluid will become trapped and macerate. Allogenic	Minimal	Tegaderm OpSite
Moist gauze	Moist gauze. May contain antiseptic, such as iodine	To maintain a moist environment in dry wounds	Non-adherent. May be antiseptic	Non-occlusive. Require fixation dressing	Nil	Jelonet, Bactogras, Inadine
Hydrocolloid	Soft pad	Ulcers, leg ulcers, stoma sites	Promote autolytic debridement	Cannot be used on dry wounds	Moderate	Duoderm Aquacel
Foam	Soft pad	Ulcers or other chronic wounds	Promote autolytic debridement, conformable	Relatively expensive. Often cause localised erythematous reaction	Moderate	Biatain Ag, Mepilex Border
Fixation	Thin roll with a single adhesive side	Holding a non-adhesive dressing in place	Can be cut to any shape	Not a sole dressing	Nil	Mefix, Hypafix
Calcium alginate	Woven and fibrous	Exudating or mildly bleeding wounds	Highly absorbent. Haemostatic	Contraindicated in drier wounds	High	Kaltostat, Sorbisan
Negative pressure dressing	A sponge with a transparent film attached to a pump	Large, deep, contaminated wounds. Highly exudative wounds	Removes heavy exudate, oedema and infected material. Promotes angiogenesis	Expensive Disruptive to patient	High	VAC, PICO, Renasys

From Deutsch et al (2017)

based on the principles of patient optimisation, education and addressing reversible factors. Those involved may include dieticians, tissue viability team and potentially surgical teams. Hence management of pressure ulcers demonstrates that a multidisciplinary team approach is required for treatment to be successful.

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Conflicts of interest

The authors declare no conflicts of interest.

Acknowledgement

Figure 1 is reproduced by kind permission of Wounds UK, Figure 3 is reproduced by kind permission of National Pressure Ulcer Advisory Panel.

Key points

- Pressure ulcers develop when there is enough pressure to impair blood supply to the underlying tissue and can include friction and shearing forces.
- Some patient groups are at higher risk and all patients should be risk assessed on admission to secondary care.
- Pressure ulcers are staged as per the International National Pressure Ulcer Advisory Panel/European Pressure Ulcer Advisory Panel pressure ulcer classification system.
- Accurate ulcer assessment is vital as this will then guide the appropriate treatment such as dressing or adjuncts.
- Antibiotics should only be used when signs spreading cellulitis, osteomyelitis or systemic infection. Topical antibiotics should not be used.
- Debridement should be considered where necrotic tissue is present and without debridement healing would be delayed. In particular, if wound or systemic infection present then sharp debridement should be considered first line.
- Pressure ulcers can lead to several complications: infection ranging from cellulitis to sepsis, prolonged hospital admissions, pain and in long term non-healing ulcers squamous cell carcinoma.

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Curriculum checklist

This article addresses the following requirements from the general internal medicine training curriculum:

- Managing an acute unselected take
- Providing continuity of care to medical inpatients, including management of comorbidities and cognitive impairment
- Managing a multidisciplinary team including effective discharge planning

Westby MJ, Dumville JC, Soares MO, Stubbs N, Norman G. Dressings and topical agents for treating pressure ulcers. Cochrane Database Syst Rev. 2017;6(6):CD011947. https://doi.org/10.1002/14651858.CD011947

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