Prevention and management of moisture-associated skin damage

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Abstract
The harmful effects of excessive moisture on a patient’s skin are well known. While traditionally considered an issue only encountered in continence care and older people, it is now recognised that the harmful effects of excessive moisture can occur across the lifespan and in various patient groups. The term ‘moisture-associated skin damage’ describes the spectrum of inflammatory damage that occurs in response to the prolonged exposure of a patient’s skin to perspiration, urine, faeces or wound exudate. It is generally accepted that moisture-associated skin damage consists of four conditions: incontinence-associated dermatitis, intertrigo, peristomal moisture-associated dermatitis, and periwound moisture-associated dermatitis. This article describes the aetiologies of each of the different types of moisture-associated skin damage, and outlines the nursing interventions required for their prevention and management.

Normal skin barrier and control of moisture
One of the major functions of healthy, intact skin is to maintain a physical barrier against the external environment. This prevents the entry of harmful substances and pathogens, and provides an important moisture barrier, preventing excessive fluid gain and loss from the body. This is achieved by the uppermost layer of the skin, the epidermis, and in particular the outermost part of the epidermis, known as the stratum corneum (Figure 1). According to the ‘bricks and mortar’ model, the stratum corneum is composed of tightly packed, flattened, protein-rich cells called corneocytes, which are held together by a lipid-rich matrix, and protein ‘rivets’ called desmosomes (Rawlings 2010). Enzymes within the epidermis act on phospholipids (a type of lipid) to produce a mixture of ceramides (lipid components of the skin’s barrier function that also assist in the...
retention of moisture), free fatty acids and cholesterol (Darlenski et al. 2011), which regulate the structure and function of the stratum corneum. The stratum corneum also contains a mix of substances that actively attract and hold water in the corneocytes, collectively termed ‘natural moisturising factor’. The natural moisturising factor acts by absorbing water from the atmosphere and deeper layers of the skin, and enables the outermost layers of the skin to remain hydrated, despite the drying action of the environment. The increase in intracellular water assists in maintaining the turgidity and shape of the corneocytes, thus maintaining a flexible coherent barrier (Voegeli 2012a).

The skin barrier is further enhanced by an acidic surface known as the acid mantle, which is maintained at a pH of between 4 and 6. This maintains a healthy balance of resident skin bacteria, and skin pH has an important role in regulating skin health and stratum corneum cohesion (Ali and Yosipovitch 2013). Disruption of these carefully balanced mechanisms can lead to either excessive skin dryness (xerosis) or a predisposition to moisture-associated skin damage, where excessive water can result in failure of the skin barrier.

Overhydration of the skin, particularly the outermost stratum corneum, can precipitate inflammation by facilitating the passage of irritants into the skin, leading to dermatitis. The exact mechanisms by which excessive moisture causes irritation remain unclear, and there has been comparatively little research into the mechanisms involved in each type of moisture-associated skin damage. However, histological studies have shown that moisture damage appears to be a result of a disruption in the intercellular lipid ‘mortar’ of the stratum corneum and the corneocytes themselves, in effect ‘dissolving’ the physical barrier (Warner et al. 2003). Once saturated, wet skin is increasingly susceptible to damage caused by friction and shearing forces; also, further irritation and inflammation can occur because the normal skin flora is able to penetrate the disrupted skin barrier and activate the skin’s well-developed immune defences (Newman et al. 2007).

**Incontinence-associated dermatitis**

IAD, also known as perineal dermatitis – or ‘diaper dermatitis’ or ‘nappy rash’ in infants – is one of the most widely recognised and studied types of moisture-associated skin damage (Gray et al. 2012, Beeckman et al. 2015). Estimates for the prevalence of IAD vary from 6-50% of patients, and are highest in those with faecal incontinence, or who live in residential care settings (Beeckman et al. 2015). The main risk factors for the development of IAD are: incontinence of urine, faeces or both; frequent incontinence episodes; use of occlusive faecal or urinary containment products; suboptimal skin condition, for example as a result of ageing or corticosteroid use; suboptimal mobility or dexterity; and an inability to maintain personal hygiene (Kottner et al. 2014).

Typically, IAD presents as inflammation of the skin surface characterised by redness, and, in extreme cases, swelling and blister formation. In people with urinary incontinence, this generally affects the labia in females or the scrotum.

**Figure 1. Structure of the skin**

(Adapted from Voegeli 2012b)
in males, as well as the inner thigh and buttocks in both sexes. If untreated, IAD can rapidly lead to excoriation and skin breakdown, and in obese individuals it often co-exists with intertrigo in the skin folds of the groin. This may subsequently become infected by skin flora, for example Candida, leading to a cycle of increased inflammation and skin breakdown (Campbell et al 2017).

The exact mechanisms that cause IAD are not well understood; however, it is generally agreed that urinary incontinence alone does not necessarily lead to IAD, but that the risk is significantly increased when combined with faecal incontinence or the passage of liquid faeces (Beeckman et al 2015). IAD is thought to be caused by overhydration of the epidermis and an increase in skin pH away from the protective slightly acidic range. The change to an increasingly alkaline pH activates digestive enzymes present in the faeces, which further contribute to the damage caused to the epidermis. Liquid faeces tends to be richer in digestive enzymes, which, when combined with its higher water content, is particularly damaging to the skin (Beeckman et al 2015).

Comprehensive clinical guidelines for the prevention and management of IAD are available (Beeckman et al 2015), and from these a simple categorisation tool for IAD has been developed and validated: the Ghent Global IAD Categorisation Tool (GLOBIAD) (Beeckman et al 2017, Beeckman et al 2018). This tool consists of two categories based on the presence of persistent redness (category 1) and skin loss (category 2), both of which are subdivided based on the presence of clinical signs of infection.

Individuals with incontinence and/or IAD are also at increased risk of developing pressure ulcers (Beeckman et al 2014, Kottner et al 2014, Gray and Giuliano 2018).

**Intertrigo**

Intertrigo, also known as intertriginous dermatitis, is a common inflammatory skin disorder that occurs in skin folds as a result of moisture becoming trapped because of inadequate air circulation (Black et al 2011). The incidence of intertrigo in the large skin folds of adults is estimated to be 6% in acute care settings, 17% in nursing home residents and 20% in adults receiving care in their homes (Mistiaen and van Halm-Walters 2010).

Intertrigo is primarily caused by trapped moisture in skin folds that causes the skin to ‘stick’ together, thereby increasing friction. This can occur in any areas of the body where there are two skin surfaces in close contact with each other, such as between the toes or fingers, but is more common in the natural large skin folds of the body (axillary and inguinal areas), as well as under the breasts in women (Black et al 2011). Babies are particularly prone to developing intertrigo in the neck folds, as a result of flexed postures, drooling and having short necks (Janniger et al 2005).

In obese individuals, several factors increase the likelihood of the development of intertrigo. For example, the skin folds are more pronounced, and intertrigo commonly occurs under the abdominal or pubic panniculi (layers of fatty tissue) (Mistiaen and van Halm-Walters 2010). Furthermore, the associated issues of increased sweating and reduced dexterity can make it challenging to ensure these areas remain clean and dry, and a direct relationship between the degree of obesity and incidence of intertrigo has been demonstrated (Waldman and Kettler 2016). Perhaps because of recent increases in rates of obesity, intertrigo is one of the few forms of moisture-associated skin damage that has a specific code within the International Classification of Diseases (ICD-11) (World Health Organization 2018).

Initially, intertrigo presents as mild, mirror-image erythema on each side of a skin fold, but may progress to more severe inflammation with erosion, oozing, exudation, maceration (skin breakdown) and secondary infection (Hahler 2006). This combination of warm, moist and damaged skin provides the ideal conditions for microorganisms to breed. Fungal infections are common, including Candida, and dermatophytes (pathogenic fungi) such as Trichophyton often complicate interdigital intertrigo (Janniger et al 2005). Several bacterial species often co-exist, such as staphylococci, streptococci, Pseudomonas and Proteus, and may include antibiotic resistant strains such as methicillin-resistant *Staphylococcus aureus* (MRSA) and vancomycin-resistant *Staphylococcus aureus* (VRSA) (Janniger et al 2005). The presence of ‘fiery’ red lesions and a foul odour often suggests bacterial rather than fungal infection (Neri et al 2015), and bacterial culture and sensitivity should be obtained to ensure optimal treatment is initiated.

A particular variation of secondary infection that may be seen in intertrigo, particularly in individuals with diabetes mellitus, is caused by the organism Corynebacterium minutissimum. This bacterial infection leads to a condition known as erythrasma, in which brown skin discolouration occurs in the intertriginous areas.

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**Key points**

- The term ‘moisture-associated skin damage’ has been used to describe the spectrum of damage that occurs as a result of the prolonged exposure of a patient’s skin to various sources of moisture, including urine or faeces, perspiration, wound exudate, mucus, or saliva
- Moisture-associated skin damage is a general umbrella term that comprises four common conditions, which often co-exist: incontinence-associated dermatitis, intertrigo, peristomal moisture-associated dermatitis, and periwound moisture-associated dermatitis
- Since the single causative agent in moisture-associated skin damage is the overexposure of the skin to moisture, the main preventative measure should be to avoid excessive contact of the skin with moisture
- The provision of optimal skin care is also important in the prevention and management of moisture-associated skin damage
If not effectively managed, any initial secondary infection in intertrigo can progress into more serious soft tissue infections such as cellulitis, particularly in patients with diabetes, and can lead to sepsis (Black et al 2011).

Peristomal dermatitis
Colwell et al (2011) defined peristomal dermatitis as inflammation and erosion of the skin surrounding a stoma that is related to moisture damage. Although peristomal dermatitis is traditionally associated with colostomies and ileostomies, it can occur with any type of stoma, including tracheostomy, gastrostomy or urostomy. Skin irritation and breakdown are the most frequent issues reported by patients with a stoma (Meisner et al 2012). Accurate incidence rates for peristomal dermatitis are challenging to ascertain, however, because of differences in definitions, nursing assessment and reporting mechanisms (Haugen and Ratliff 2013). The incidence of peristomal complication rates reported in the literature range from 10-70% of patients, with the type of stoma being an important factor (Colwell et al 2011).

Stomas producing more liquid outputs that are rich in active digestive enzymes, such as ileostomies, are associated with an increased frequency of skin complications and potential for serious skin breakdown (Ratliff 2010). Similarly, the literature suggests that patients tend to experience peristomal skin breakdown within the first 6-12 months after surgery, thus it may be linked to the developing self-care skills of patients (Salvadalena 2008).

Leakage around the stoma that leads to excoriation and breakdown of the skin is a common complication in patients with a gastrostomy (Rahnemai-Azar et al 2014), particularly early on, although ascertaining accurate prevalence rates is challenging. The skin around a gastrostomy can quickly become excoriated and break down as a result of leakage of feed or liquid rich in digestive enzymes around the stoma site (Rahnemai-Azar et al 2014). Similarly, the skin surrounding a tracheostomy is subjected to damage from the accumulation of sputum around the stoma and friction from the tracheostomy tube, ties and dressings. Moisture-associated skin damage of the peristomal skin is a common issue, occurring in almost 40% of patients with a tracheostomy (Karaca and Korkmaz 2018).

Periwound moisture-associated dermatitis
The production of wound exudate is often a normal result of the initial inflammatory phase of wound healing. In some wounds, however, high volumes of exudate are produced, which can negatively affect the surrounding skin and overall wound healing. The skin around the wound edges becomes overhydrated and macerated, leading to further skin breakdown and delaying wound healing by impairing keratinocyte migration (Colwell et al 2011).

Maceration of the skin surrounding a wound presents as pale, white and ‘wrinkly’ skin, and tends to be more of an issue in chronic wounds because of the composition of the exudate. It has been suggested that differences in the composition of the exudates produced by acute and chronic wounds are one of the main factors that contribute to periwound skin damage (Colwell et al 2011). There is no evidence that normal moist wound healing causes maceration, since although the exudate from acute wounds contains proteolytic enzymes, these tend to be inactive. This is in direct contrast to chronic wounds, for example venous leg ulcers, where there is a higher number of proteolytic enzymes (such as matrix metalloproteinases) and proinflammatory cytokines in the exudate, which tend to be active and predispose the patient to skin breakdown (Colwell et al 2011). Several types of wound have been shown to predispose to skin maceration, such as venous leg ulcers, diabetic foot ulcers and pressure ulcers, which are all wounds that may produce high volumes of exudate.

Preventing and managing moisture-associated skin damage
Since the single causative agent in moisture-associated skin damage is the overexposure of the skin to moisture, the main preventative measure should be to avoid excessive contact of the skin with moisture. For some patients with moisture-associated skin damage, however, completely removing the moisture source is often unrealistic and non-evidence-based ritualistic practices such as the use of soap and water to clean patients who have been incontinent often predominate, particularly when providing skin care.

While the quality of evidence for the prevention and management of the different forms of moisture-associated skin damage varies, and is generally low, there is an accumulated body of knowledge and several expert clinical consensus documents to guide practice (Sibbald et al 2013, Beekman et al 2015), with the recommendations being incorporated into local protocols. Gray et al (2011) outlined four principles for preventing and managing moisture-associated skin damage, as listed in Box 1. These principles continue to be refined, and Woo et al (2017) provided a useful review of the existing evidence on which to base interventions.

The provision of optimal skin care is one of the most important actions that can be taken to prevent and manage moisture-associated skin damage. Ideally, the skin care provided to patients with any form of moisture-associated skin damage should be based on a structured regimen and involve the use of a gentle skin cleanser, a skin protectant (barrier product) and moisturiser, if indicated. The use of ordinary soap and water should

**Box 1. Principles for preventing and managing moisture-associated skin damage**

- Adopt a structured skin care regimen
- Use products to wick moisture away from at-risk skin
- Control the cause of excessive moisture
- Treat secondary infection

(Gray et al 2011)
be avoided, because in most cases the pH of the soap is too alkaline and may contribute to the skin irritation (Voegeli 2012a). Several of the newer cleansing products available combine a cleanser with a skin protectant and moisturiser, and are pH-balanced to maintain the normal slightly acidic skin pH. With a growing range of products available, there is limited evidence to guide choice, and some healthcare professionals view them as an unnecessary expense (Beeckman et al 2016). There is increasing evidence, however, which demonstrates that these products may be cost-effective in the long term (Bliss et al 2007, Pather et al 2017). Adherence to a skin care protocol is made easier by reducing the number of separate products used, which can also save nurses’ time (Beeckman et al 2011).

Following cleansing, it is important to protect the patient’s skin against subsequent contact with moisture using a skin protectant or barrier product. These are designed to repel moisture and protect the skin from the harmful effects of excessive moisture. Basic barrier preparations consist of a lipid and water emulsion base with the addition of metal oxides, for example zinc or titanium, which form a thin layer on the surface of the skin to repel potential irritants. Sophisticated barrier preparations often contain a water-repellent silicone-based ingredient such as dimeticone, as well as mild antiseptic agents such as cetrimide or benzalkonium chloride. Nurses should, however, be aware that some of these ingredients can cause irritation in sensitive individuals, particularly if the patient’s skin irritation appears to worsen when using a barrier preparation.

A new generation of barrier products have been developed, which enable a thin semi-permeable protective silicone-based polymer coating to be applied to the skin, for example the Cavilon skin care range, SKIN-PREP range or LBF Barrier Cream. In some situations, these polymers appear to have an advantage over more conventional products, by offering greater protection against repeated moisture exposure (Brennan et al 2017). Similar principles should be applied in individuals whose skin has already broken down. This should begin with a reassessment of the issue and identification of the likely cause. In severe excoriation of the skin, active measures may be required to contain the moisture source, thus protecting the skin. For example, in IAD this could involve the use of urinary sheaths to keep urine away from the skin, or a faecal containment device. In an individual with a stoma, changes to the pouch system being used and the introduction of a silicone-based skin protectant can be beneficial, although specialist advice from a stoma nurse may be necessary (Steinhagen et al 2017). These actions should be combined with the initiation of a structured skin care regimen, as outlined earlier in this article.

If assessment of the skin breakdown suggests a fungal infection is present, it may be necessary to incorporate an antifungal cream into the skin care regimen. If bacterial infection is suspected, appropriate use of topical or systemic antimicrobials may be indicated, ideally following sensitivity results and in accordance with local antimicrobial prescribing policies. In patients with intertrigo, care must be taken to ensure all the skin folds are carefully examined, and thoroughly cleaned and dried, and that efforts are made to improve air circulation and reduce friction (Sibbald et al 2013). Initially, the nurse should undertake this examination, then teach the patient how to care for the skin, because recurrence of intertrigo is common. The use of excessive talcum powder, gauze or towels between the skin folds should be avoided since these practices may increase the risk of fungal infection and paradoxically increase moisture trapping (Black et al 2011). In recent years, there has been an increase in products designed to prevent and manage intertrigo. The most widely used are ‘biotextiles’, which have evolved from the growth of specialist textiles used to manufacture sportswear, where moisture wicking and improving air circulation are important factors in maintaining comfort. A biotextile specifically for use in the prevention and management of intertrigo (InterDry) has been developed and is designed to wick and absorb moisture, reduce friction and contains silver as an antimicrobial agent. The product has been used successfully in North America for some years, and has been shown to be both clinically effective and cost-effective in managing intertrigo (Blackett et al 2011, Sibbald et al 2013).

The management of periwound dermatitis is based on the same principles outlined previously in this article, but is often a balancing act in attempting to control excessive moisture without causing excessive drying of the skin (Colwell et al 2011). Most guidelines for the management of heavily exudating wounds advocate using highly absorbent dressings together with frequent dressing changes (Wounds UK 2013); however, this should be balanced against the risk of causing skin trauma when removing dressings (Rolstad et al 2012). The use of a skin protectant on the periwound skin should be considered, as should a collection device for the exudate, or negative pressure therapy.

**Conclusion**

The term moisture-associated skin damage refers to four main conditions: IAD, intertrigo, peristomal moisture-associated dermatitis, and periwound moisture-associated dermatitis. Careful assessment can assist in distinguishing between these conditions and enable appropriate prevention and management interventions to be implemented. Whatever the cause of the excessive moisture, a structured skin care regimen should be commenced to cleanse and protect the skin. This should be followed by methods to keep the skin dry by wicking away excessive moisture, controlling the source of the excessive moisture and treating any secondary infection. Investment in the development and adoption of clear skin care protocols locally can lead to improvements in the patient experience and improve clinical outcomes and quality of life.
References


