

Skin changes and skin care for people with diabetes at the end of life

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Article points

1. The protective function of the skin deteriorates as the skin ages and skin failure can occur.
2. Older people with diabetes are susceptible to skin damage and infections.
3. End-of-life wound care focuses more on symptom management rather than wound healing.

Key words

- End of life care
- Kennedy terminal ulcer
- Older people
- Skin failure

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The skin provides a protective barrier to the outside world and the threat of damage, but that function deteriorates as the skin ages, making older people more prone to infections, pressure ulcers and skin failure. This is compounded by any comorbidities, particularly diabetes, which can increase skin dehydration and can also encourage fungal infections and pressure damage. This article looks at the ageing process in the skin and details the changes that occur at cellular level. The author advises people caring for older people at the end of life to have a skin care regimen in place that ensures that the skin is hydrated and that the symptoms of any pressure damage or wounds should be managed so they do not cause the patient pain or discomfort.

The primary function of the skin is to serve as a protective barrier against the external environment. In order to achieve this protection there is a stratified, impermeable and avascular layer of dead keratinised skin scales (the epidermis), which is waterproof, prevents water loss and acts as a barrier against bacterial invasion of the dermis.

The skin is the largest organ of the body and is as susceptible to failure as any other organ system and yet minimal literature exists on skin failure. Skin failure is defined as an event in which the skin and underlying tissue die due to hypoperfusion that occurs concurrent with severe dysfunction or failure of other organ systems (Langemo and Brown, 2006). Healthcare workers should be aware of this phenomenon and consider this during assessments and when providing end-of-life care. This is particularly relevant to people with type 1 and type 2 diabetes as their skin has a higher vulnerability to failure.

In 2009, an expert panel was established to formulate a consensus statement on skin changes at life's end (SCALE) (Sibbald et al, 2009). It maintained that skin is essentially a window into the health of the body and it can provide a great deal of insight into what is happening inside the body if the signs are read correctly. This includes changes related to a decrease in

skin perfusion and localised hypoxia, with the result of reduced availability of oxygen and the body's ability to utilise vital nutrients and other factors required to sustain normal skin function.

Many patients will be elderly at the end of life and will often be malnourished. They may have multiple comorbidities and be severely ill and this makes their skin vulnerable to pressure damage, skin tears and general deterioration. Added to this, if they have diabetes they will already be at far higher risk of pressure injury (Institute for Clinical Systems Improvement, 2012).

The skin's stratum corneum (its outer layer) has a water content of 10–30% under normal conditions, and the signs and symptoms of dry skin become apparent in many people when its water content falls below 10% (Kraft and Lynde, 2005), leading to xerosis (dryness) and pruritus (itching), which are both common in older people. The importance of keeping skin healthy is often underestimated. Establishing a skin care regimen is essential to maintaining healthy and hydrated skin. Dehydrated skin is rough and scaly, and dryness occurs most often over the lower legs, hands and forearms and can be triggered by medications, such as diuretics, or chronic illnesses (Hess, 2008).

Page points

1. Cutaneous ageing is a complex process.
2. The dermis loses 20–80% of its thickness due to ageing.
3. The hyperglycaemic environment favours immune dysfunction.

The increasing prevalence of xerosis with advanced age is believed to be the result of alterations in keratinisation and in the lipid content of the stratum corneum, as well as the cumulative effect of environmental factors and physical damage to the stratum corneum (Scott, 2012; Weber et al, 2012).

Diabetes can exacerbate this condition and xerosis is common in older people with diabetes. If left untreated, the pruritus that can be associated with xerosis will cause scratching and discomfort, and may lead to infection. People with diabetes tend to show reduced hydration of the stratum corneum together with decreased sebaceous gland activity (Sakai et al, 2005).

Skin and the older person

Cutaneous ageing is a complex biological phenomenon consisting of intrinsic ageing, which is largely genetically determined, and extrinsic ageing is caused by environmental exposure (Jenkins, 2002). Among the epidermal changes associated with ageing are a flattened dermal-epidermal junction, giving the appearance of atrophy and cellular heterogeneity. The melanocyte density declines slowly, Langerhans cells decrease in number and there is attenuation in the number and diameter of elastic fibres in the papillary dermis with an increase in the number and thickness of the same fibres in the reticular dermis along with a coarsening of collagen fibres with an increase in density of the collagen network (Kurban and Bhawan, 1990). Elastin becomes stiffer due to cross-linking and the amount of calcium bound to the elastin fibres increases with age. In some atherosclerotic arteries, the internal elastic lamina is specifically and strikingly calcified (Majno and Joris, 1996). This compromises the skin as it limits the flow of oxygen and nutrient-rich blood to the organs, such as the skin.

The underside of the epidermis becomes increasingly flattened out in both exposed and protected areas of progressively older people. This flattening is accompanied by a comparable rarefaction of the superficial blood vessels (Montagna, and Carlisle, 1979). The reduced synthesis of collagen types I and III means that the older person's skin is vulnerable and will be more difficult to heal. Additional comorbidities, such

as diabetes, put the older person in the high-risk category for wound development and poor healing, particularly at the end of life.

The majority of age-dependent changes that occur in the skin happen in the dermis, which loses 20–80% of its thickness due to ageing (Branchet et al, 1990). Fibroblasts in the dermis are the cells responsible for collagen, elastin and glycosaminoglycan biosynthesis in the dermis, and this reduces as we age. The collagen and elastin are produced at a slower rate and this impacts the skin's ability to repair.

Diabetes and skin disorders

Those at the end of life who also have diabetes are more likely to have problems with the skin. Up to a third of people with diabetes will have a skin disorder caused or affected by diabetes at some time in their lives (Jelinek, 2007).

The skin has been described as a vast empire in which contrasts of terrain and climate are as varied as those of the earth itself (Hallett, 1994). Within this vast empire is an environment of microorganisms, with the most common inhabitants being bacteria. The body normally hosts a variety of these microbes, including bacteria and fungi. Some of these are useful to the body, some are neutral and some can cause harmful infections. Certainly, there are many different types of bacterial infections and fungus that can commonly affect the skin of people with diabetes (Diabetes New Zealand, 2015).

The greater frequency of infections in people with diabetes is caused by the hyperglycaemic environment that favours immune dysfunction (such as damage to the neutrophil function, depression of the antioxidant system and humoral immunity). Micro- and macro-angiopathies, neuropathy and a greater number of medical interventions also increase the risk of infection (Casqueiro et al, 2012).

People with diabetes are also vulnerable to fungal infection. *Candida albicans* is a yeast-like fungus that is responsible for many fungal infections causing skin problems in people with diabetes. The incidence of fungal *Candida* and diabetes have risen sharply in recent years and there are more than 53,000 studies, with 2,466 recorded in 2013 alone, and this may be due to excess sugars, which are an excellent source of fuel that can rapidly increase the growth of *Candida*.

Box 1. Bacteria facts.

- There are between 2 million and 10 million bacteria between fingertip and elbow
- Damp hands spread 1,000 times more germs than dry hands
- Bacteria double in number every 20 minutes
- The number of germs on the fingertips doubles after using the toilet
- Germs can stay alive on hands for up to 3 hours.

Source: <http://www.glowtec.co.uk/wash-and-glow/wash-and-glow-about.htm>

As we age, the immune system becomes decreased (Moini, 2012). This means that older people are at higher risk of developing an infection. Added to this is the fact that people with diabetes are far more likely to develop clinical infection. Therefore, at the end of life (and particularly in patients with diabetes) it is vital to ensure infection control (see *Box 1* for facts on bacteria).

Pressure ulcers and wound healing

Skin failure can be categorised as acute, chronic, or end-stage. Pressure ulcers, a type of skin death, frequently occur in people with a heavy disease burden, especially those at or near the end of life, despite good care (Langemo, 2006).

Caring for wounds at the end of life changes the focus from healing to the control of wound-related symptoms to improve comfort and quality of life. Maintaining a moist wound environment is one of the main principles of wound care, but this goal may alter in the end stages when symptom control becomes more important than healing.

At the end of life:

- Blood pressure may be low and delivery of blood to the wound reduced
- Oxygen delivery to the wound may be reduced
- Nourishment may be reduced due to lack of appetite.

This all makes a wound more likely to occur and healing to be delayed. Wound-related symptoms that require control at the end of life are:

- Pain
- Exudate
- Malodour
- Infection
- Bleeding
- Dressing comfort

- Negative psychological and social functioning (Chrisman, 2010).

Type 1 and 2 diabetes have several direct and indirect effects on the healing of wounds and can delay healing as the functional impairment of polymorphonuclear neutrophils that occurs in all people with diabetes and poor delivery of nutrients and oxygen to the wound will increase the risk of infection and slow the healing process.

Non-enzymatic glycation is the mechanism by which proteins, such as collagen, are subject to chronic attack from glucose (Majno and Joris, 1996). In wound healing this has huge implications if the blood glucose of the patient with diabetes is not stabilised. In people with diabetes, collagen becomes increasingly brown. Majno and Joris (1996) describe the process as the ‘browning reaction’ and explain it as follows: “If milk is cooked for a long time, sugar and proteins combine to form a brown and bitter-burnt tasting product called melanoidins. This reaction contributes to the brown colour and toughness of cooked meat. Scientists have found that it is this same reaction involved in diabetes (and ageing).” Accelerated arteriosclerosis, neuropathy and joint stiffness are the results of this ‘browning’. An example of this glycation reaction would be cataracts or atherosclerosis leading to poor bloody supply and kidney failure. Glycation end-products have also been isolated from Alzheimer’s lesions in the brain.

Kennedy ulcers and care of pressure ulcers at the end of life

Skin organ compromise at life’s end is not a new concept. The first clinical description in modern medical literature appeared in 1989 (Sibbald et al, 2009) with the Kennedy terminal ulcer. This is a type of pressure ulcer wound that is seen at the end of life (Schank, 2009). The Kennedy terminal ulcer is a sacral pear, butterfly or horseshoe shape or sometimes an irregular-shaped red/yellow/black ulcer, similar in appearance to an abrasion or blister that may occur suddenly, often at 3am in the morning (Kennedy-Evans, 2009; Schank, 2009). It presents as larger than other pressure ulcers and is usually more superficial initially but develops rapidly in size and depth (Graves et al, 2013).

Palliative care is designed to ensure a comfortable and peaceful death. Pressure ulcers will rob the

patient of that right as they are painful and a great deal of extra care is required in order to prevent them from worsening.

While it is agreed that at the end of life it will not always be possible to prevent pressure injury (Black and Langemo, 2010), every effort should be made to reduce the risk while keeping the patient comfortable. The Department of Health (2010) has produced a guide on how to define unavoidable pressure injuries. This guide states that if everything has been done to protect the patient, then no one is responsible. However, if nothing is done to protect, the care givers are responsible and the wound classified as avoidable.

Skin care for older people with diabetes

Patients at the end of life, particularly those with diabetes, must be treated with moisturisers in order to combat the dehydration of the skin. It is important to be aware that many moisturising creams contain allergens such as parabens, so care must be taken to ensure the cream is suitable for the individual. Unperfumed bath oils are ideal and they can be used to soak the feet and maintain moisture in the skin.

The National Institute for Health and Care Excellence has highlighted how basic hygiene protocols, such as hand washing, may be overlooked by some healthcare professionals, which may threaten patient safety (NHS Choices, 2014). When providing skin care for older people at the end of life:

- Maintain good hand hygiene to prevent cross-infection
- Use moisturising creams, bath oils and unperfumed, neutral pH soaps
- Keep the skin on the feet dry
- Ensure that end-of-life patients' skin is well protected and symptom-free where at all possible.

Conclusion

The skin provides vital protection against the environment and it is essential to maintain its health and integrity. As we age, the skin becomes more vulnerable and requires greater maintenance, particularly in people with diabetes. Good care of the skin earlier in life will pay dividends at the end of life in a reduction in infection risk, lower pressure ulcer risk, and a reduced potential for pruritus and xerosis. When caring for patients at the end of life

it is important that the skin is adequately hydrated and that the skin is assessed for any signs of infection or pressure damage, particularly in patients with comorbidities, such as diabetes. Care for wounds at the end of life may often focus on the relief of symptoms, rather than on wound healing. ■

“As we age, the skin becomes more vulnerable and requires greater maintenance, particularly in people with diabetes.”

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