Skin Care

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Introduction

The skin is the largest organ in the body and it is essential that clinicians involved in pressure area care are cognizant of the need to maintain or improve its condition. Healthy, normal skin is the first and best line of defense against the invasion of microorganisms, chemicals, and trauma. The skin is constantly exposed to potential irritants and chemicals, any of which may cause damage [1]. Furthermore, the skin has an immune defense function through its Langerhans cells. Part of the immune system that fights foreign invaders like viruses and bacteria. The skin is also a production plant using the energy of the sun to make vitamin D, essential for many functions of the body.

In addition, mechanical forces, allergy, inflammation, systemic disease, and burns also impair skin integrity, producing a range of responses. These include erosion, pressure ulceration and ulceration, erythema, papules, and vesicles [2].

With regard to pressure ulcer prevention and management of the older person, skin care is a particular challenge, as people live for longer and are continually raising their expectations of healthcare. In addition, the developed world is experiencing increased numbers of older people within their populations. Davies [3] reports that despite differing welfare systems country policies for older people are broadly consistent in their targets. The aims of such policies are to maintain older people in

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their chosen environment, whilst promoting autonomy and a meaningful life [4–6]. Nolan [7] describes global initiatives that aim to prevent or delay ill health, where nurses are encouraged to be proactive in improving the health of older people, especially in the community setting.

In the UK an Audit Commission review [8] recommended that increased attention be paid to the problems of incontinence in patients cared for in the community. Incontinence has been identified as a factor that precedes skin damage and it would seem appropriate that preventing and managing incontinence should be an important aim of nursing care. As people become older, protection of the skin against the effects of incontinence is of particular importance, and as recommended by Le Lievre [9], the development of cost-effective, evidenced-based management strategies should be a priority.

Normal Skin

Originating from the embryonic ectoderm and mesoderm, the skin is the largest organ in the human body, making up approximately 16% of total body weight (about 9 kg) and covering a surface area of 1.8 m^2 [10]. The skin has four main functions: protection, sensation, vitamin D manufacture, and thermal regulation. Additional functions include acting as an energy and water reserve, excreting urea and salts in sweating.

Protection

The skin provides protection against loss of water and electrolytes, chemical and mechanical assaults, bacterial and pathogenic invasion, and ultraviolet radiation. In essence, the skin maintains a homeostatic environment and acts as a barrier.

Sensation

This is part of the body's ability to protect itself from the surrounding environment. Normal skin is sensitive to pain, touch, temperature, and pressure, through its network of nerve endings or receptors. When stimulated these receptors transmit impulses or signals to the cerebral cortex where they are interpreted.

Manufacture of Vitamin D

Vitamin D is synthesized in the presence of daylight. Epidermal cells synthesize 7-dehydrocholesterol, converting it to cholecalciferol or vitamin D when exposed to ultraviolet rays [10].

Thermal Regulation

In health normal core body temperature is around 37 °C. The skin controls this optimum temperature by the two mechanisms of sweating and blood circulation. When the body is too warm vasodilation occurs, which draws blood to the surface of the skin so cooling it down. In addition, sweat coats the skin's surface and as it evaporates, also cools the skin. When too cold vasoconstriction of blood vessels redirects heat to the body core and internal organs so preserving heat. At the same time shivering results from the arrector pili muscles attached to hair follicles contracting. This has the effect of causing the hairs to stand erect so preserving heat by forming an insular layer of air between the hair and skin.

The epidermis and the dermis are the two layers of which the skin is comprised. Supporting these main layers is a layer of subcutaneous fat as insulation and protection from physical forces, although some parts of the body including the heels, elbows, and shins do not have this protective fatty layer.

The Epidermis

The epidermis is a protective and physical barrier, very thin. It is composed of cells called keratinocytes. The keratinocytes meet five different stages of the course of their life, starting from the deepest part of the epidermis where they are born, rising up to the surface where they will then fall apart. During their existence they undergo cornea cytomorphosis or keratinogenesis passing from living cells endowed with nucleus, to dead cells without nucleus and forming simple corneal lamellae that determine the keratinization of the skin and its protection.

The epidermis also serves to protect against radiation from the sun. this function is carried out by the melanocytes found in the basal layer of the epidermis. These cells when they are exposed to light they produce melanin which helps to protect against ultraviolet radiation.

The epidermis is the avascular, outer layer of the skin nourished by the diffusion of nutrients, and is thickest on the soles of the feet and palms of the hands [11]. Starting from the outside it comprises six layers:

- Horny layer—stratum corneum. The horny outer layer consisting of cells that are dead and desquamating. These cells are thin and flat and keratinized.
- Clear cell layer—stratum lucidum. The translucent layer, just below the stratum corneum and only present where the skin is thickened. The cells comprising this layer contain large amounts of keratin, and this layer is commonly found where trauma and friction are evident, leading to the development of calluses and corns.
- Granular layer—stratum granulosum. The precursor of keratin, keratohyalin a granular substance is found in this layer. Keratohyalin gradually replaces the cytoplasm of the cells in this layer.
- Prickle cell layer—stratum spinosum. The cells that comprise this layer are characterized by the fine cusps or processes that resemble prickles. These hold the cells together and protect against the physical forces of shear and friction.

- Basal layer—stratum basale. The layer joins the dermis and contains cells that are rapidly dividing. Over a period of 21–28 days these cells migrate up to the outer layer of the epidermis.
- The epidermal/dermal junction. Here there is an undulation of dips and peaks, the rete malpighii pegs that help to give strength to the skin, protecting from physical forces such as shear and friction.

The Dermis

The dermis is the layer of skin under the epidermis. It is a thicker layer of connective tissue that contains nerves, blood and lymphatic vessels, hair follicles, collagen and sweat glands. The blood vessels of the dermis help to maintain a constant body temperature. Collagen and elastin are produced by cells called fibroblasts. Collagen and elastin give turgidity and elasticity to the skin.

This vascular layer is derived from the embryonic mesoderm and is approximately 0.5–3 mm in thickness. Well supplied by blood vessels and nerves, it contains hair follicles, blood capillaries, sebaceous glands, and sweat glands. These structures are contained by a matrix of collagen and elastin and form support for underlying structures. Between 40 and 80% of total body water is held in the dermis [10]. The dermis includes the following structures and cells:

- Ground substance. The gel-like material in which connective tissue cells and fibers are embedded. It provides an emergency water store.
- Tissue mast cells. These cells are closely approximated to hair follicles and blood vessels, producing heparin and histamine, as part of tissue repair when injury to the skin occurs.
- Tissue macrophages. These cells are able to engulf and digest foreign bodies such as debris and bacteria and are especially active when tissues are injured. Macrophages also play a key role in regulating the healing process.
- Collagen fibers. Collagen is the major structural protein and is secreted by dermal fibroblasts as tropocollagen. Normal human dermis mainly consists of type I collagen, a fiber-forming collagen. Type I collagen accounts for between 77 and 85% of collagen [12]. Collagen is the protein that gives skin its tensile strength.
- Elastin fibers. Another dermal protein that provides skin with its elastic recoil properties. Elastin prevents skin from being permanently misshapen and these fibers form spirals or coils that allow for distraction and return to normal configuration. It contains high amounts of proline and glycine, though it accounts for less than 2% of the skin's dry weight [12].
- Lymph vessels. Drain excess fluid and plasma proteins from the dermis [10] and connect with the body's lymphatic system.
- Nerve endings. Sensory or afferent nerves that carry information about the outside world to the brain and spinal cord, and continually monitor the environment of individuals. The sensory nerves convey the sensations of heat, cold, touch, and pain. Specialized sensory receptors are found in the dermis (and also in the basal layer of the epidermis).

- Sweat glands—sudoriferous glands. Spiral structures composed of epithelial tissue that emerge from the dermis or subcutaneous tissue, opening by a duct onto the surface of the skin. They secrete a mixture of water, sodium chloride, and small amounts of urea, lactic acid, and potassium ions. In extreme temperatures as much as 3.5 kg of body weight can be lost in a day.
- Sebaceous glands. There are thousands of these minute holocrine glands on the skin that secrete an oily, colorless, odorless fluid, sebum, through the hair follicles. Sebum is a moisturizing substance that forms a waterproof covering.

How Age Damages Skin

As the years go the skin undergoes changes. The functionality of the skin is reduced: increase in transepidermal water loss (TEWL), the ability of the skin to fight infections; adjusting body temperature also decreases. During several cell cycles, DNA can be damaged and cells can grow without control, resulting in skin cancer.

Reduces the concentration of collagen and elastin in the dermis. Increased lines of expression deeper around the mouth and forehead. Hair and nails are thinner and brittle.

Thinning and Loss of Elasticity

It is estimated that the paper-thin appearance of the skin in older people is due to a 20% reduction in dermal skin thickness compared to youth [1]. In the normal aging process, the epidermal junctions become flattened and dermal papillae and epidermal rete ridges or pegs are destroyed, rendering the skin vulnerable to physical damage as the epidermal layers can more easily separate from each other [1]. Skin also loses elasticity as the fibroblasts responsible for elastin and collagen synthesis decline in number, elastic fibers thicken, and the ability for elastic recoil is lost, so causing creases and wrinkles.

Reduction of Fatty Layers and Drying

At the same time the amount of subcutaneous or adipose fat lessens, so providing less of a cushion for underlying bone. This occurs primarily in areas such as the face, shins, hands, and feet. Additionally, natural moisture from sebum secretion reduces in old age, as these sweat glands become smaller, leading to increased dryness of the skin. Overall, the aging process adversely affects skin quality causing dry, thin, inelastic skin that is susceptible to damage. Potential sources of skin damage include pressure, friction, and shear, either individually or in combination. In addition, damp skin caused by exposure to excessive moisture is more vulnerable to shearing forces and at risk from loss of barrier function. Incontinence in old age renders the skin vulnerable to damage when excess or caustic moisture from urine, stool, or frequent washing reduces skin tolerance.

How Incontinence Damages Skin

It is an expected norm that adults are in control of bladder and bowel functions, incontinence only being tolerated in babies and the very young. Indeed, much value is often placed on children's achieving continence in the western world. However, epidemiological research reports that the number of people experiencing incontinence far exceeds the number that seek help and advice from healthcare professionals [13]. Not a disease in its own right, incontinence is a symptom of a broad range of underlying conditions. Incontinence is most common in older women, affecting 11.6% of all women included in a postal survey of 22,430 people [14]. In this survey stress incontinence and urge incontinence were significantly increased in parous women compared to nulliparous women, particularly in those who had borne four or more children.

There is some evidence that attitudes towards incontinence are improving. Willis [15] reports the value of a national awareness campaign by the Department of Health and the Continence Foundation in directing people to the appropriate professional services. In addition, the Royal College of Physicians report that the number of people seeking healthcare advice is increasing [16].

Swaffield [13] highlights the extent of the problem of incontinence in healthcare institutions and social services facilities. She reports that many surveys have demonstrated high rates of incontinence in these care settings and argues that this is due to inappropriate assessment and intervention on the part of healthcare professionals. Swaffield also suggests that there is a need not only to correctly identify patients who could be treated but also to improve public and professional understanding, assessment, treatment, and management of incontinence. A recent census of nursing care and care homes [17] highlighted incontinence as being extremely prevalent, where caring for patients' incontinence problems accounted for the greatest input in nursing time.

Urinary Incontinence

The most common types of urinary incontinence are stress incontinence, urge incontinence, and overflow incontinence:

- Stress incontinence is a failure of the urethral sphincter that results from a weakness in the pelvic floor, which allows the urethra to descend and the sphincter to open. This type of incontinence commonly occurs with sudden abdominal pressure on the bladder, usually on coughing, laughing, or sneezing.
- Urge incontinence is caused either by an overactive detrusor function (motor urgency) or by hypersensitivity (sensory urgency). This type of incontinence is caused by contraction of the detrusor muscle of the bladder leading to the urge to void even though only a small amount of urine has collected.
- Overflow incontinence is caused by urinary retention that arises due to an obstruction (feces or tumor), an underactive detrusor muscle or failure of the urethra to open.

Fecal Incontinence

This is far less common than urinary incontinence. Johanson and Lafferty [18] report fecal incontinence as being especially prevalent in older people and those requiring long-term care. This type of incontinence is typically caused by constipation or fecal impaction, and also by damage to the pelvic floor and anal sphincter.

Maceration and Incontinence Dermatitis

Maceration occurs a result of prolonged exposure of the skin to excessive moisture from profuse sweating, urinary incontinence, and wound exudate. Cutting [19] describes macerated skin as a frequent result of urinary incontinence. He cites literature from 1974 onwards and reports a strong relationship between excessive skin moisture and the development of pressure ulcers. Hampton and Collins [20] highlight the problem of maceration and associated excoriation as increasing the risk of damage to the skin from friction.

As discussed above, patients generally experience urinary incontinence more frequently than fecal incontinence. Fiers [21] highlights the harmful effects of urinary incontinence on the skin where bacteria and ammonia cause undesirable alkaline skin conditions and destructive enzymatic activity is also increased. However, Leyden et al. [22], Berg [23], and Kemp [24] suggest that a combination of urinary and fecal incontinence is most harmful to skin. Urine and feces together raise the pH of skin and thus increase the harmful activity of proteases and lipases. Andersen et al. [25] described this when reporting the results of a study that included healthy human volunteers. These researchers observed that when applied directly onto healthy skin, the digestive enzymes found in feces caused severe skin irritation. Exposure to excessive moisture increases the permeability of the skin and leads to a reduction of the skin barrier function. Patients in whom the skin barrier function has been disturbed in this way are at risk from developing contact dermatitis, an exogenous eczema, caused by external factors that have either irritated the skin or caused an allergic reaction [26]. Incontinence dermatitis is an irritant dermatitis, which occurs as a result of high moisture exposure, friction, bacteria, and enzymatic activity. Nursing assessment tools and clinical guidelines designed to identify patients at particular risk of skin damage highlight both urinary and fecal incontinence as contributory factors [27].

The Evidence that Rejects the Use of Soap and Water

When patients experience episodes of incontinence they are washed to remove the harmful chemicals contained in urine and/or feces and also to eliminate malodor and promote patient comfort. When patients are frequently incontinent it follows that they are washed frequently. If soap and water is used the pH of skin alters, becoming alkaline instead of acidic, thus adversely affecting its protective function [28]. The pH of normal skin is about 5.5,which is referred to as the “acid mantle”

because this pH prevents bacterial growth and inhibits the action of digestive enzymes [1]. As the skin becomes more alkaline, it increases its permeability to watersoluble irritants [29], thus rendering it more vulnerable to tissue breakdown. Soap consists of fatty acids or triglycerides and has been used as a cleansing agent for thousands of years. In general use soap is beneficial. Kirsner and Froelich [30] report the benefits of using soap in healthcare for infection control to cleanse skin and prevent disease, but this is not the case for patients who are experiencing incontinence. Alkaline soap reduces the thickness and number of the layers of cells in the stratum corneum and emulsifies and removes the protective lipid coating of the skin [12]. She reports that it takes 45 min to restore normal skin pH following washing with soap, and that prolonged exposure may need 19 h. In addition, washing macerated, excoriated skin with soap and water will lead to dryness of the skin from a decrease in skin surface lipids.

The Evidence that Supports the Use of Specialized Skin-Care Products

Skin care of the incontinent patient consists of a regimen of skin cleansing and skin protection with a barrier preparation. Lutz and White [31] report the benefits of using specialized skin moisturizers when caring for patients with incontinence as it relieves dryness and protects against excessive moisture and irritants. These researchers report that specialized skin protectants provided better protection against washing than other protectants. Other research has demonstrated the effectiveness of implementing skin-care protocols for patients with incontinence. Lewis-Byers et al. [32] report the results of a small randomized controlled trial in which it was found that the use of soap and water together with a moisturizer was less effective and more time-consuming than using a no-rinse cleanser and a durable barrier cream. Bale et al. [29] report similar results in a study that explored the benefits of implementing a new skin-care protocol that included the introduction of specialized skin-care products. These researchers report a statistically significant reduction in the incidence of incontinence dermatitis and grade 1 pressure ulcers in combination with significant savings in staff time and product costs.

Elements of Skin Care

The US Agency for Health Care Policy and Research (ACHPR) guidelines for managing patients with urinary incontinence [27] recommend that: skin is inspected regularly, gently cleansed with a mild cleansing agent immediately after soiling, absorptive pads are used, and topical barriers are used to protect the skin from moisture.

- Skin inspections. Skin condition should be assessed regularly. For the older person with incontinence this may be daily or more frequently.

- Assess level of continence and treat incontinence appropriately. This may involve adapting patients' physical environment to include providing clothing that can be easily removed, physiotherapy, improving access to toilets, providing walking aids and assistance to access toilets, regular toileting or provision of commode, and regular cleansing and changing of soiled incontinence aids.
- Skin care. The aim here is to keep the skin clean, dry, and well moisturized to maintain the best barrier possible against skin damage. The use of specialized, pH-balanced skin cleansers, the avoidance of damaging soaps, and protecting skin with skin barriers appropriate to individual patient needs are important elements.

How Excessive Wound Exudate Damages Skin

Wound fluid has a beneficial role to play in wound repair in a normal healing acute wound. It has been shown that in the normal healing process high levels of enzyme activity, responsible for clearing the debris from the wound, decrease as the wound heals. However, research studies suggest that exudate from chronic ulceration appears to have a damaging effect on normal wound healing due to continued raised levels of tissue destructive enzymes [33–35].

Normal skin barrier function has been shown to be compromised in peri-wound skin compared to normal skin [36]. Excessive exudate can damage the vulnerable peri-wound skin through enzymatic activity and by causing physical damage to the structure of skin. Cutting and White [37] argue that when patients have existing pressure ulcers, the exudate that drains can cause skin damage by irritating the surrounding skin. In chronic wounds, proteases (present in the exudate), particularly matrix metalloproteases, are thought to actively damage healthy skin through their enzymatic action [35].

Excessive wound exudate can cause physical damage to the structure of the skin. Cutting [19] describes how the stratum corneum initially absorbs fluid, causing swelling. Further saturation reduces barrier function, leading to skin breakdown. As with urinary incontinence the peri-wound skin can become macerated from prolonged contact with the wound exudate.

Protection of the Peri-Wound Skin from Wound Exudate

The aim of exudate management is to achieve an optimal moisture balance within the wound environment and prevent damage to the surrounding skin. Dressing choice and peri-wound protection plays a large part in patient comfort. It is important to understand how the different dressings handle moisture and thus their suitability for the wound and the expected wear time. Dressings with adhesive borders should be avoided on patients with edematous tissue, fragile skin, wet skin, or where there is localized inflammation present around the wound.

Prolonged exposure to wound exudate on previously healthy skin may result in maceration and further loss of epithelium. The macerated skin may appear white, thickened, and hard. The use of a suitable skin protectant applied to the peri-wound skin will prevent skin damage from wound exudate and reduce the risk of further loss of epithelium. Where maceration and inflammation are present, the skin will appear erythematous and may be moist or weeping [38]. The patient may complain of burning, stinging, and itching of the affected area. Treatment of erythematous maceration may require the application of a topical corticosteroid preparation to reduce the local inflammation prior to the use of a barrier preparation. Creams are easier to apply to wet skin than ointments. A potent topical steroid should be used for 1–2 days only and gradually reduced over the next few days. A barrier preparation can then be applied to the peri-wound area as a skin protectant. Various skin barrier preparations are available including ointments, creams, and a barrier film that leaves a protective film on the skin surface. The barrier film comes as a spray and also in an impregnated foam on a stick. It can be applied to vulnerable skin under adhesive dressings to aid adhesion and prevent trauma on removal.

Prevention of Pressure Injuries

Prevention of hospital-acquired pressure injuries (HAPI) remains a crucial clinical challenge especially for those patients undergoing surgery. in addition to standard of preventive interventions (anti-decubitus mattress, active or passive patient mobilization) the use of a 5-layer silicone foam applied in the areas under pressure (sacrum, heel, etc) resulted in a significant decrease of pressure injuries [39].

Skin Care at End of Life

In USA one fifth of population will be 67 years or older by 2040 [40], and more and more people are experiencing more comorbid diseases in their last years. Concomitant with this demographic change is the fact that the number of frail elderly patients will increase and will probably elect palliative rather than curative care at the end of life. Overall, there is limited information on wounds at the end of life. There are few studies on the prevalence and incidence of wounds at the end of life. The prevalence rates reported between 13 and 47% [41, 42], and incidence rates from 8% to 17% [41–43]. Most, if not all, people at the end of life are at risk for developing soft tissue ulcerations. Decubitus ulcers occurring at the end of life are often unavoidable and largely attributable to malnutrition and immobilization of patients. Individuals at the end of life who have a wound confront several problems, including accepting a palliative approach or more aggressive wound treatment. Patients should be advised that many wounds at the end of life do not heal. The rupture of tissues in patients at the end of life is caused by several factors: low concentration of oxygen in the tissues, low levels of hemoglobin and alterations in the

gas exchange. With age, the skin becomes more frail, thinner and prone to injury; healing could be delayed. As the end of life approaches, activity and mobility decrease, leading to tissue ischaemia by prolonged pressure. Comorbidities and pain can have a negative impact on mobility; the elbows, the sacrum and the heels are particularly vulnerable to pressure. The presence of moisture—for example, wound exudate, sweat and feces or urine - makes the tissue much more vulnerable to friction, increases the risk of tissue breakage. The elderly hunger and thirst have decreased, resulting in dehydration. Malnutrition and protein-caloric dehydration compromise skin turgidity. All these factors leave the tissue vulnerable to new cracks and compromise the normal wound healing mechanisms.

Wound Care

The goals of palliative and wound healing wounds vary little from one another, apart from the goal of healing. Palliative care becomes the main objective when the patient's general state has expired, the wound does not improve or deteriorate significantly, where aggressive interventions are no longer appropriate or quality of life can no longer be improved. The care target is then redirected to palliation. Palliative care includes: pain management, wound management, the appropriate choice of medication, reducing the risk of infections, peri-wound protection, reducing odors. The care goals will focus on improving the quality of life.

Prevention and Treatment of Wounds

In general, the recommendations to maintain skin integrity include a gentle cleansing with a low pH skin cleanser, the use of barrier creams to maintain good hydration. It is useful to minimize the damaging effects of incontinence. During mobilization of the patient, the buttocks and sacral areas must be protected. Although a general guideline is to reposition an individual in bed every 2 h, it is necessary to consider the general state of the patient: hemodynamic instability, pain, nausea or vomiting. With reduced ventilation capacity at the end of life, many people require the head elevation of the bed. The guideline is to keep the head of the bed as low as possible—preferably 30° or less—to minimize friction [44].

Dressings for wounds. Normal comfort is improved with fewer dressing changes, so it is advisable to select a dressing for several days. The sacral area or other bony prominences should be protected with a low friction coefficient, foam or hydrocolloid film to minimize friction.

The exudate of the wound is the fluid that oozes from the extracellular spaces. Protecting periwound tissue is important and can be a challenge; Excessive exudate can cause perilesional maceration. The exudate can be managed by a barrier cream on the periwound zone or skin protection. In the case of minimal exudate, a hydrocolloidal, hydrogel or composite dressing works well. With moderate exudate it can use a hydrogel, hydrocolloid, foam, composite or calcium alginate. When the

exudate is a composite, plentiful, hydrophilic or calcium alginate, expanded dressing should be selected.

Chronic wounds are considered colonized with bacteria [45]. During colonization, microorganisms are present and replicate on the wound surface. In the event of infection, bacteria invade healthy tissue and produce pathophysiological effects. At the end of life, patients have a compromised immune system that is less able to fight infection. The classic signs of wound erythema, pain, infection, edema and purulent exudate, heat.

Necrotic tissue and debridement. Necrotic tissues can promote the growth of bacteria. It becomes essential to remove the necrotic tissues by surgical or medical debridment.

The smell of wounds can be embarrassing for the patient. it is necessary to change the dressing more frequently. Non-viable tissues must be untangled; Autolytic debridement is often the least painful method for the individual. Surgical debridement is not recommended because it is often considered excessive bleeding and excessive pain.

Based on the guidelines, pain assessment is now mandatory on a routine basis(Based on the distribution of pain VAS scores), even for people unable to express pain.. Individuals with cognitive impairments can be assessed by observing behaviors such as facial expression, vocalizations, changes in activity, body movements or changes in mental status such as crying or irritability.

Pain control should be part of the patient's goals and wishes related to care. The management of pain associated with wounds is achieved through a balance between adequate wound care, necessary medications and conservative measures. Analgesics should be prescribed according to the guidelines of the World Health Organization (WHO) for pain control.

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