POSITION DOCUMENT

ITALIAN WOUND CARE ASSOCIATION
(ASSOCIAZIONE ITALIANA ULCERE CUTANEE - AIUC)

SKIN: IDENTIFICATIONS OF CRITERIA FOR A CORRECT MANAGEMENT

AM. IPPOLITO, P. LUI, R. CASSINO, P. CUFFARO, M. T. SCALISE, M. D’ELIA
R. RAVALDI, S. MORI, B. RITROVATO, O. FORMA, A. CORSI, M. PIERANGELI

ACTA VULNOLOGICA 2012
VOLUME 10, N. 3 PAG. xxx-xxx
Skin: identifications of criteria for a correct management

Skin ulcer pathology skin is a pathology which is unknown not only from a treatment but also from an organisational and procedural point of view. Within the context of a pathology which is already rarely understood, the culture and cure of what surrounds an ulcer, namely the skin, is, if at all, even rarer.

The state of the skin could change in many situations: by ageing, state of nutrition, dehydration situations, lack of hygiene, the presence of scar tissue from previous traumas or skin ulcer lesions, instances of urinary or faecal incontinence.

Skin observation provides important information both to assess the physiopathology of the ulcer, and to decide on proper treatment.

Then, of extreme importance is a particular treatment of the perilesional areas: a perilesional rashed, burning, sore skin which does not receive proper treatment would delay the healing process which should start right from the edges of the ulcer; on the other hand a perilesional skin which is normotrophic and well vascularised which is not protected from any ulcer hyper sudation can head on towards maceration and, in the long run, cause an increase rather than a decrease in the size of the ulcer.

To conclude, I think it would be proper to affirm that a good skin tropism and a healthy perilesional skin would facilitate ulcer healing, whatever its etiopathogenesis might be, while a “problematic” skin complicates and lengthens the healing process.

The document on “The Skin”, prepared with so much care, sharing and competence by a group of experts of the Italian Skin Ulcer Association covers all anatomical, physiological and physiopathological aspects relating to the skin and provides the therapeutic elements required to improve our patients’ treatment.

Therefore, I consider it merits to be read carefully not only by members of our Association but also by carers who attend daily to patients suffering from skin ulcer.

Giovanni Mosti
Anatomy and physiology of the skin

The skin is the largest organ of the human body and its integrity is very much like a person’s calling card. It has a complex structure consisting of a deep compartment made up of dermis and subcutaneous tissue and a surface area with several cell layers called the epidermis (Figure 1).

Between the two compartments lies the basement membrane, the actual creator of all exchanges between the two compartments.

For a substance to penetrate the dermis from the outside, it is necessary to take into account the structure and methods of surpassing the basement membrane. Similarly, the arterial/venous circulation, which is found in the deep compartment, stops immediately below the membrane, the nutrients are released into the papillary dermis and the basement membrane itself acts as a filter towards the epidermal cells. The germinative cells are laid out in a single layer above the membrane, reproducing vertically and thus starting off a process of cell differentiation resulting in the formation of the epidermis layers. Once it detaches itself from the basement membrane, a cell loses its ability to multiply and starts to produce an amorphous substance which, by combining itself with keratin precursors, forms keratohyalin granules. These keratohyalin granules then combine themselves with even larger and more solid masses and progressively substitute cellular organelles. The cell becomes harder, stiffer and biologically inactive. Its combination with another two substances, filagrin and involucrin, renders the stratum corneum much stronger and more resistant to external trauma.

The stratum corneum cells are flattened, joined together by an amorphous cementing substance that tends to disappear as the cellular layers surface, thus allowing the desquamation in small cell clusters.

In the palmar plantar, there is a layer of two rows of flattened cells (stratum lucidum) just below the stratum corneum. These cells are rich in eleidin, an amorphous substance which contributes to the greater thickness and resistance of these two areas.

Melanocytes, responsible for producing melanin, are located just above the basement membrane. They are arranged between the keratinocytes in a ratio ranging from 1:4 to 1:10 with respect to the basal cells. Between the various layers, Langerhans cells are found: these are mobile cells capable of crossing the various dermo-epidermal layers and they carry out an immunological function by capturing antigens and presenting them to the T lymphocytes.

The dermis contains an amorphous substance that is rich in water as well as reticular, elastic and connective tissue fibres. Amongst these are several structures, such as the pilosebaceous follicle with sebaceous glands, sweat glands and nerves, both sensory and motor, and numerous cells, e.g., mast cells, fibroblast cells, haematological-derived cells.

The sebaceous gland is attached to the
SKIN AGEING
Paraphysiological mechanisms linked with ageing

The anatomical and physiological aspects of the skin are very much affected by aging. "Ageing" is understood to mean a series of typical alterations during a period of life, consisting mainly of elasticity loss, wrinkle formation, xerosis, reduced glandular secretion and vascular fragility (Figures 2, 3). These events are not of a pathological nature, but rather alterations and onsets attributable to progressive degenerative processes of the skin that are unquestionably linked to temporal progression. It is for this reason that such events should not be considered as a "disease", but simply as a change linked to the "aging experience", more appropriately defined as a "paraphysiological state".

Essentially, skin aging is linked to genetic and environmental factors. With the passing of years, the metabolism slows down, provoking a reduced production of proteins required to maintain the skin's structure. Therefore, besides the loss of tone, pigmentation changes and the accentuation of fine lines and wrinkles, damage occurs to cellular DNA which is stimulated by environmental factors, thus causing the premature death of cells or their altera-
In summary, skin ageing depends on intrinsic biological mechanisms (age related), genetic predisposition, condition of health and extrinsic factors, predominantly sun exposure. This phenomenon, referred to as “photo ageing”, is directly proportional to UV radiation exposure.

The ultraviolet radiations that induce premature ageing and promote the skin carcinogenesis process are those that vary between 280 and 320 nanometres in wavelength.
The thus-induced DNA alteration contributes to the alteration of the process of keratinization (dyskeratosis); both weigh heavily on “photo-induced precancerous” lesions (keratosis and actinic cheilitis).

Amongst the “paraphysiological changes” to clinical expression, some of the most common are highlighted herein, as well as the typical senile lentigines and seborrheic verruca:

— *cutis rhomboidalis nuchae*: thickening of the posterior neck skin, characterized by the deep furrowing of the skin at acute angles, thus forming diamond-shaped areas;

— *citrine skin of Milan*: patches of yellow skin, in the facial area, similar in appearance to the lemon peel, due to accentuated follicular openings;

— *nodular elastosis with cysts and comedones* (Favre-Racouchot Syndrome): brown and wrinkled skin, characterized by cysts and numerous black comedones, primarily localized in the temporal and zygomatic areas;

— *senile purpura* (Bateman’s purpura): usually localized to the back of hands and forearms, consists of several bluish-red ecchymotic areas due to degenerative processes of the skin that cause poor support to the capillaries.

Histological changes that accompany skin aging are abnormal bundles of collagen and elastic fibers that are coarse and fragmented.

Tables I, II show clinical and histological aspects of ageing, divided into biological and photo-induced aspects.

**Pathological changes of senile skin**

Vascular, metabolic and immune conditions are the main causes of age-related geriatric skin alterations; however, these are only partly specific to age since they are often already present but in latent form. There are no age-related skin diseases in the strictest sense, but there is mention of an increased risk of certain disorders associated with aging; chronic degenerative forms and tumours are more common than those of an infectious or allergic nature.
Generalized eczema is also commonly observed. It is resistant to the most common treatments and has a tendency to worsen, often accompanied by intense itching. This type generally starts off on the lower limbs and gradually spreads to the rest of the body. It is essentially dependent on a particular state of dryness and scaliness of the skin as a result of a decreased in sebum secretion (asteatosi), thus leading to the gradual atrophy of the pilosebaceous unit.

In old age, main bullous dermatoses are significantly more frequent, (pemphigus and Lever's pemphigoid), as well as vascular-dependent skin alterations due to venous/arterial diseases and metabolic disorders (Figure 4).

Frequent in elderly persons are also precancerous (actinic keratosis and bowenoid lesions) and simple neoplastic (basalioma and spinalioma) formations; especially from the seventh to eighth decade of life onwards (Figures 5, 6).

Intertriginous candidiasis is amongst the main forms of skin infections. It is most frequently localized to larger skin folds (submammary region) and in the spaces between toes. Vulvovaginitis and candidal balanitis are less frequent and are fundamentally linked to diabetes.

**How to change skin care in the geriatric years**

With regard to senile skin, it is necessary first to ask this question: “Should we treat the skin of an elderly person with the same attention as that of a new-born baby’s skin?” There is no doubt that the question is rhetorical as far as the answer is concerned: while we know that the answer should be “yes”, we are also fully aware that the situation, from a practical standpoint, is completely different. The elderly are certainly not lent the same care, which is considered sacrosanct and necessary, as that which is given to a new-born; children are identified as weak and helpless, yet we know perfectly well that this description is more fitting to the status of the older generation - at least in the context of today’s society.

The skin needs every attention possible in both new-borns and infants as well as throughout adulthood and even more so in old age: protecting our “outer covering” should be a priority, as well as trying to keep it in perfect working order so that it can protect us from external agents, help us to thermo-regulate and also protect us from bacterial aggression. This priority is not dependent on age: maceration induced by urine and faeces cause the same damage in a new-born as in an elderly person, except that the response in terms of tissue repair will be much more rapid and effective in a child than in a geriatric subject. This is not because the products at our disposal are differentiated based on age, but rather because the two metabolisms are significantly different.

From a local perspective, it is important to focus on hygiene and prevention, as well as on specifically designed products. However, great importance must also be given to nutritional and nutraceutical aspects, that is, treatment of body imbalances using nutrients to supplement nutrition, as if they were a drug therapy. To this end, supplements based on antioxidants are used with undoubted benefits. This acts in synergy with a healthy and correct diet: “eat better to age gracefully”.

**HEALTHY SKIN MANAGEMENT**

Inspection and skin care are considered the fundamental and indispensable principles involving care of patients with skin lesions or intact skin - regardless of age. Recent EPUAP guidelines devote ample space for discussing this subject.

The objective of healthy skin management is to identify reasonable actions to achieve the set target based on the latest evidence, namely healthy skin maintenance, from the fundamental difference between healthy skin and intact skin, without overlooking mucus membranes and their attachments which, if properly managed, certainly reduce the problems associated with skin disorders.
Healthy skin means skin where there are no cracks, abrasions, cuts or abnormal openings (stomata) that allow pathogens to enter. Intact skin means skin that is not affected by lesions.

It is important to observe and evaluate: complexion, thickness, elasticity, temperature, integrity, odour, pain, moisture and dryness.

**Skin care**

**Cleansing**

The purpose of cleansing is to remove the exogenous and/or endogenous “dirt” from the surfaces of our bodies. It is important to remember that:

- the endogenous dirt comes from tissue debris and sebaceous secretions;
- the exogenous dirt derives from environmental contamination that is deposited on and in the hydro-lipidic film. The latter is essential for the physiological maintenance of skin homeostasis since it determines and influences the level of protection and the ability to resist aggressive agents. The correct cleansing, therefore, should respect as much as possible the hydro-lipidic film and effectively remove any dirt while preserving the natural moisturizing factor (NMF).

There are two types of cleansing: using cleansing surfactants and the so-called lipophilic cleansing:

### Table III.—Potential allergenics according to Directive 2003/15/EC promulgated by the European Union.

<table>
<thead>
<tr>
<th>Allergenic substances</th>
<th>INCI name</th>
</tr>
</thead>
<tbody>
<tr>
<td>2-benzyl-idene-heptanal</td>
<td>Amyl cinnamal</td>
</tr>
<tr>
<td>Benzyl alcohol</td>
<td>Benzyl alcohols</td>
</tr>
<tr>
<td>Cinnamyl alcohol</td>
<td>Cinnamyl alcohol</td>
</tr>
<tr>
<td>Citral</td>
<td>Citral</td>
</tr>
<tr>
<td>Eugenol</td>
<td>Eugenol</td>
</tr>
<tr>
<td>7-hydroxycitronellol</td>
<td>Hydroxycitronellol</td>
</tr>
<tr>
<td>Isoeugenol</td>
<td>Isoeugenol</td>
</tr>
<tr>
<td>2-pentyl-3-phenylprop-2-ene-1-ol</td>
<td>Amyl cinnamyl alcohol</td>
</tr>
<tr>
<td>Benzyl salicylate</td>
<td>Benzyl salicylate</td>
</tr>
<tr>
<td>Cinnamaldehyde</td>
<td>Cinnamal</td>
</tr>
<tr>
<td>Coumarin</td>
<td>Coumarin</td>
</tr>
<tr>
<td>Geraniol</td>
<td>Geraniol</td>
</tr>
<tr>
<td>4-(4-Hydroxy-4-methylpentyl)cyclohex-3-ene carbaldehyde</td>
<td>Hydroxyisohexyl 3-Cyclohexene carbaldehyde</td>
</tr>
<tr>
<td>4 methoxybenzyl alcohol</td>
<td>Anise alcohol</td>
</tr>
<tr>
<td>Benzyl cinnamate</td>
<td>Benzyl cinnamate</td>
</tr>
<tr>
<td>Farnesol</td>
<td>Farnesol</td>
</tr>
<tr>
<td>2 - (4-tert-butyl/benzyl) propionaldehyde</td>
<td>Butylphenyl-methylpropional</td>
</tr>
<tr>
<td>Linalol</td>
<td>Linalol</td>
</tr>
<tr>
<td>Benzyl benzoate</td>
<td>Benzyl benzoate</td>
</tr>
<tr>
<td>Citronellol</td>
<td>Citronellol</td>
</tr>
<tr>
<td>α-hexyl-cinnamaldehyde</td>
<td>Hexyl cinnamal</td>
</tr>
<tr>
<td>(R)-pMentha-1,8-diene</td>
<td>Limonene</td>
</tr>
<tr>
<td>Oct-2-methyl ynoate</td>
<td>Methyl-2-octynoate</td>
</tr>
<tr>
<td>3-methyl-4-(2,6,6-trimethyl-2-cyclohexene-1-yl)-3-butene-2-one</td>
<td>α-isomethyl-ionone</td>
</tr>
<tr>
<td>Extract of Oakmoss</td>
<td>Oakmoss Extract</td>
</tr>
<tr>
<td>Extract of Treemoss</td>
<td>Treemoss Extract</td>
</tr>
</tbody>
</table>
— surfactants are substances that lower the surface tension of a liquid, facilitating the wetting of the surfaces and the miscibility between liquids by their different nature; thus, through mechanical action and due to the properties of the surfactants themselves, this type of cleansing allows for the removal of both the surfactant molecules that join the dirt adhering to hydro-lipidic film and of the aqueous solution contained therein;

— the lipophilic cleansing corresponds to the principle of removing the fat using fat substances from the skin itself (hydro-lipidic film) and the dirt deposited therein, without the use of surfactants.

Use of lipophilic substances as cleansers and rinsing are essential.

Lipophilic substances (oil or cleansing milk) are capable of removing the hydro-lipidic film and therefore any dirt included therein, in a more eudermical method.

Although this type of cleansing is more physiological, it is also true that products next to functional lipids contain other substances (emulsifiers, preservatives) that, if they remain on the skin, may give rise to undesirable effects such as irritant contact dermatitis (ICD) and possible allergy contact dermatitis (ACD). It is therefore essential to complete the cleaning action by rinsing. It is necessary to know the products that are applied to the skin so that everything materializes in the purpose of “maintaining the skin’s wellbeing in good condition” (Art. 1 Law 713 on cosmetics).

Table III shows the 26 potentially allergenic ingredients that have been promulgated in accordance with European Union Directive 2003/15/EC.

The main skin problems we face are fundamentally linked with hydration (maceration and xerosis) and subsequent desquamation. In fact, there exists both dry desquamation, with moderate edema and superficial itching, and moist desquamation, with more severe edema, erythema and intense itching.

### Table IV.—Average composition of natural moisturizing factor (NMF).

<table>
<thead>
<tr>
<th>Average composition of NMF (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Free amino acids</td>
</tr>
<tr>
<td>Pyrrolidone carboxylic acid and its sodium salt</td>
</tr>
<tr>
<td>Urea</td>
</tr>
<tr>
<td>Lactate and lactic acid</td>
</tr>
<tr>
<td>Sodium, calcium, potassium, magnesium</td>
</tr>
<tr>
<td>Uric acid and other purine</td>
</tr>
<tr>
<td>Chlorides, citrates, formates, phosphates</td>
</tr>
<tr>
<td>Sugars and other</td>
</tr>
</tbody>
</table>

**Skin moisture**

Skin moisture is a fundamental parameter to be taken into consideration. This can refer either to the water content of the stratum corneum, or to the fluids present on the skin for several reasons including sweating, incontinence or leakage.

The skin is composed of 65% of water. Its structural and functional integrity and its plasto-elastic properties are closely related to the correct degree of hydration, that is, the water content of the dermis, epidermis and the stratum corneum.

If the moisture and/or the external environmental heat exceed both the heat produced by our body and the content of the water vapour that it emanates, TEWL does not occur and heat build-up occurs with serious consequences; in contrast, if the external environment is too dry and cold, there is greater water loss also accompanied by heat loss from our body. An increase in TEWL that is not supported by an adequate reintroduction of water results in dehydration, not only of the skin, but also of all the organs.

To help maintaining hydration, in addition to adequate oral fluid intake, it is worth considering products with moisturisers that involve barrier function recovery. They are water soluble and their hygroscopic properties are capable of fixing, retaining water and maintaining proper moisture in the corneous tissues.
Urea plays a very important role since it is considered among one of the main moisturizing ingredients: it should be used with doses ranging between 3% and 40% in formulations such as creams, lotions, shampoos, gels and body wash. At concentrations below 10%, it is used mainly in cosmetic moisturizing products, thanks to its activity as a humectant. With concentrations around 20% it is used as a keratolytic, while at doses greater than 40% it helps removing the hyperkeratosis of hands and feet. However, it is necessary to pay close attention to its use in patients with sensitive skin as it can provoke a burning sensation.

Table IV summarizes the average composition of NMF.

The amount of water present in the epidermis is constantly changing depending on the functional states of the individual and surrounding environmental situations. This occurs due to perspiratio insensibilis or transepidermal water loss (TEWL), and sweating.

Maintenance of skin moisture and prevention of excess

The use of barrier products can be useful to protect moist skin from further damage, in particular if caused by urine and feces.

The barrier products can be classified into:

- **water soluble products**: fat-free and fat-soluble solvents, protect against organic solvents (benzene, toluene, xylene);

- **hydrophobic products**: fat preparations that protect against water, acids, alcalis, dust.

The water soluble are composed of alginates, cellulose, mucilage, silicates, resins, inert powders; those hydro-insoluble resins, lanolin, alcohol, acetone. Both products are based on the use of film forming substances (perfluoropolyethyl-propyl ethers) which, together with the wide range of silicones (the most commonly used being dimethicone) impart a water-repellent characteristic to the creams, thus preventing skin ulceration.

In an attempt to control skin humidity, patients who are particularly susceptible to abundant perspiration, such as more overweight people, may benefit from washing and frequent changes of clothing and bedding. The accumulation of moisture between the skin folds of these patients, also often with diabetics, may in fact represent a particular problem and result in dermatitis accompanied by bacterial infections and candidiasis (Figure 7).

The cleansing should be performed preferably using synthetic detergents (SYNDET) which helps to reduce the number of bacteria and therefore reduces also the possible presence of strong odours. If, however, sweating is particularly abundant and the smell is very
The skin has a lower water content, lower levels of lipids, reduced tensile strength and flexibility as well as reduced integrity of the junctions between the dermis and epidermis. Low values of humidity also reduce the hydration of the stratum corneum; in fact, in the volume “Guidelines on the prevention of pressure ulcers”, the Agency for Health Care and Research recommends a relative humidity lower than 40% to reduce the likelihood of xerosis.

Dry skin can be:
- primitive: fragile, senile, atopic xerosis or ichthyosis (Figure 8);
- acquired: dry weather, harsh chemicals, iatrogenic causes (Figure 9).

Mild liquid detergent such as syndet should always be preferred. Mild liquid syndets, used for cleansing xerotic skin, contain an appropriate mixture of only slightly aggressive surfactants and therefore are low foaming; they may also contain lipidizing agents (linoleic acid and linoleic gum) or soothing properties (polydocanol) and preferably without perfume. It is important to remember that the skin should be dried, using dabbing motions and not wiping.

The hydration of xerotic skin should be carried out through humectants (polyols, glycosaminoglycans, elastin) that increase.

Increasing the body temperature by 1 °C, the metabolic activity of tissues in the body increases by 10%; this may cause ischemia with subsequent minor tissue perfusion resulting from the metabolic based activity. This ischemic situation, together with excess moisture, will inevitably lead to a marked increase in the risk of lesion development.

Dry skin

Dry skin (xerosis) is another important parameter to take into consideration. Dry skin has a lower water content, lower levels of lipids, reduced tensile strength and flexibility as well as reduced integrity of the junctions between the dermis and epidermis. Low values of humidity also reduce the hydration of the stratum corneum; in fact, in the volume “Guidelines on the prevention of pressure ulcers”, the Agency for Health Care and Research recommends a relative humidity lower than 40% to reduce the likelihood of xerosis.

Dry skin can be:
- primitive: fragile, senile, atopic xerosis or ichthyosis (Figure 8);
- acquired: dry weather, harsh chemicals, iatrogenic causes (Figure 9).

Mild liquid detergent such as syndet should always be preferred. Mild liquid syndets, used for cleansing xerotic skin, contain an appropriate mixture of only slightly aggressive surfactants and therefore are low foaming; they may also contain lipidizing agents (linoleic acid and linoleic gum) or soothing properties (polydocanol) and preferably without perfume. It is important to remember that the skin should be dried, using dabbing motions and not wiping.

The hydration of xerotic skin should be carried out through humectants (polyols, glycosaminoglycans, elastin) that increase.
water retention from outside the stratum corneum: with the film forming substances, “endogenous” hydration can be achieved thanks to the occlusive film created, thus preventing perspiratio insensibilis. The products involved are basically oil in water emulsions (O/W), in which the oil phase may include vaseline, paraffin, silicones, and animal or vegetable derived oils.

The use of emollients may promote hydration of dry skin and reduce the risk of skin lesions. These should be applied once daily and after each washing or bathing process.

All products that restructure the skin are recommended, also for the stimulation of fibroblasts and keratinocytes, the modulation of inflammatory processes and the restoration of hydro-lipid protection structure; preparations based on plant extracts (Boswelia, Blueberry, Tamarindo, Centella asiatica, Glycyrrhiza glabra, Aesculus hippocastanum) also have a recognized role.

For the correct treatment of xerotic skin, active antipruritic and moisturizing products are strongly recommended.

Malpractice

Sanitary malpractice, a major cause of complications involving the skin, should be understood as both misuse of medications, drugs or devices, as well as a misapplication of the product itself.

Proper skin hygiene and maintenance of skin in excellent physiological condition are the first steps to avoid mistakes. Temperature, maceration and incontinence are the main extrinsic factors that promote skin damage, as when subjected to prolonged excessive moisture, the skin absorbs water and loses its barrier function (Figure 10).

Consequently, areas such as the perennal area, skin folds and spaces between the fingers and toes are those more susceptible to maceration, as they are exposed to an increased risk of skin lesion in the event of sanitary malpractice.

Special attention should be paid in already complicated situations due to the presence of implants and/or aids, such as naso-gastric tubes, glasses/oxygen masks, tracheostomy, PEG tubes, abdominal ostomies and urinary catheters: this approach is equally important for patients with a stump on their leg, thigh or foot since poor placement of the prosthesis can cause skin lesions.

Incontinence

It is essential to properly manage your bladder weakness to maintain healthy skin, together with the correct implementation of personal hygiene, appropriate preparation of the patient's bed and at a reasonable choice of the absorbent product: highly absorbent incontinence pads associated with surface dryness and increased breathability should be used and changes should be performed at intervals appropriate to individual needs (Figure 11).

Absorbent products meeting specific requirements in relation to the types of incontinence should always be used.

The incontinence pads should be stretched out prior to the patients using them in order to minimize the formation of folds.

In patients with sustained incontinence, incontinence pads should no longer be used since they further decrease the effectiveness of the device and the pressure distribution: the skin temperature also increases, favoring maceration and the onset of contact dermatitis.
If the placement of the catheter is opted for, incontinence pads should never be used. If necessary, due to fecal incontinence, a shaped containment product is preferable.

**Personal hygiene**

**Skin should be cleaned as soon as it becomes dirty and at regular intervals.** We recommend using a mild detergent to minimize skin dryness and use detergents with a physiological pH (5.5-6).

— Rinse thoroughly and pat dry -- especially in skin folds.
— During the cleansing process, minimize the force and friction applied to the skin.
— Minimize skin exposure to moisture caused by incontinence, perspiration or secretions.

The following must be avoided:
— use of too hot/too cold water;
— application of alcoholic solutions;
— use of powders, because irritating and drying;
— body massage over bony prominences;
— incongruous use of products for topical use;
— colored antiseptics as they disfigure skin color (modified and dried).

**The feet are a part of the body to which practitioners and patients themselves often devote little attention.** A health-care malpractice of the feet can cause severe skin damage. In diabetic patients the errors may even lead to amputation of the limb.

The daily cleansing process is the perfect time to check the space between the toes, nails, and the plantar skin and heel spurs. In fact, the hyperkeratotic area (Figure 12), tilomi and onicodistrofie can change the mobility of a person even to defeat. Nails should be cut after having been softened in warm water. However, if nails are particularly long or deformed, it is necessary to consult a podiatrist.

— Urinary and fecal incontinence is one of the main causes of skin ulcerations.

| All individuals at risk should be subject to a skin inspection at least once a day, identifying skin conditions and paying close attention to bony prominences. |
| Uncooperative individuals should be encouraged to inspect their own skin and hot spots. |
soiled with excrement. In remaking the bed, linen should be flat on the mattress, preventing the formation of folds: for patients who spend many hours in bed, avoid the use of tarpaulins: the use of disposable under pads is controversial, especially if the bed is provided with an antibedsore mattress, since this will diminish its effectiveness.

It is important to remember that any object forgotten on the surface of the bed (caps and infusion catheters, personal items and food wastes) can cause skin damage (Figure 13).

**PERISTOMAL SKIN MANAGEMENT**

Ostomy or stoma is a word that originates from the Greek meaning “mouth” and is the result of a surgically created opening in the body for the discharge of bodily wastes.

The indications for the packaging can be:

- neoplasms;
- chronic inflammatory diseases;
- trauma;
- congenital malformations

and when you can no longer maintain normal bowel or urinary tract. In some cases the ostomy is packed within the body to bring the nutrients as in the case of a gastroscope (PEG) or jejunostomy (PEJ).

The peristomal skin is the part that stretches for 8-10 cm around the stoma onto which the collection pouch is applied (Figures 14, 15).

---

**Figure 14.—Stoma and peristomal skin.**

**Figure 15.—Plaque for the attachment of the collection guard.**
The life of a patient, from both the physical and the psychological standpoint is conditioned by this new situation; the proper sealing of the pouch is crucial, to prevent the occurrence of complications that could condition them negatively. For the person with a stoma, these 10 cm are the most important! They must be looked after and preserved from all corruption. The deterioration of this portion of the skin, in fact, prevents the adhesion of the collecting system and is therefore significantly degrading on the quality of life.

The intestinal ostomies are subdivided into ileostomy and colostomy, depending on which part of the intestine is exteriorized.

They may be:
— temporary, once the cause is resolved, it will be possible to restore normal intestinal transit;
— permanent.
Stomata can be:
— terminal, when the last part of the bowel exteriorizes;
— double-barrelled, when the bowel is exteriorized and dissected so as to form “2 mouths”;
— ileostomy: is packaged using the last portion of the ileum. Waste products excreted are always very generous and extremely irritating because they contain all the digestive enzymes that have not yet been processed by bacteria found in the colon, and it alters the pH.

There are various types of ostomy which can be fitted to the colon, indicated generally by the name of colostomy:
— cecostomy, formed on the cecum, characterized by irritant feces, and abundant liquidity. In recent years, this type of ostomy is increasingly rare, with a preference to deviate outside the ileum rather than the cecum. It was used to decompress the colon in cases of intestinal obstruction;
— transverse colostomy, a surgical opening created in the transverse colon resulting in case of intestinal obstruction or as a decompressive stoma for the terminally ill: becoming increasingly rare due to the size of the stoma, which is almost always double barrel and is difficult to manage because of location in the center of the abdomen;
— sigmoid colostomy, the most common type of ostomy surgery, as regards the final ostomy is easy to manage because the feces are almost normal and slightly irritant, having undergone the absorption of water and the modification of the PH, that occurs in the colon.

Particular attention should be paid to the management of ileostomies and cecostomies because of the abundant liquid and extremely irritant excretion that is produced.

Urinary ostomies involve the opening of a urinary tract through the skin.

In the case of a cystectomy there are two types of ostomies:
— ureterocutaneostomy, with exteriorization of the ureters;
— ureteroileocutaneostomy (or Bricker procedure), with the anastomosis of the ureters to a section of defunctionalized ileum and its exteriorization to the skin. It forms, thus, an ileal conduit whose purpose is not of a reservoir, but simply to pass urine to the outside.

Preoperative plan

The objectives of the preoperative plan are to:
1) identify the place in which to pack the stoma to prevent secondary complications of poor positioning;
2) ensure a condition that allows the person to manage hygiene and the stoma apparatus easily and autonomously;
3) facilitate the applicability and the ad-

In urinary ostomies, the risk of dermatitis is very high owing to the histolytic action of urine which tends to infiltrate under the collection pouch more easily.
you can check the exact position in various postures: upright, supine, sitting, etc. You must also take into account the living habits, clothing, religion etc. of the person with a stoma (in some religions, a person is not permitted to be “dirty” above the belt line).

Stoma and peristomal skin care

The hygiene of the stoma should be performed daily or at every change of the pouch collection. One of the major objectives of health professionals is the education of the patient or caregiver in order to ensure, in addition to the normal management of the stoma, early recognition of the onset of complications or problems (Figure 17). For cleaning the stoma, drinking water detergent solutions should be used at PHYSIOLOGICAL pH, using non-woven cloth or gauze.

Avoid at all costs the use of antiseptics or histolesive solutions such as gasoline, ether or alcohol.

A correct and atraumatic detachment of the pouch to be replaced is achieved by disconnecting a corner of the baseplate and applying gentle downward pull, aiding the detachment with a paper towel or non-woven gauze moistened with warm water. Once the pouch has been removed, clean the stoma and peristomal skin with a detergent, rinse and dry the skin by dabbing with a paper towel or a bidet towel.
Ostomy pouching systems

Ostomy pouching systems can be divided into two categories:
— one-piece systems: the hydrocolloid and/or microporous adhesive and the bag form a single body;
— two-piece systems: composed of hydrocolloid and/or microporous baseplate and a separate collection system;
— the bags may be closed bottom for colostomies or open bottom for ileostomies giving the possibility to empty the pouch several times a day due to the emission of liquid faeces in quantities higher than that emitted by colostomies. For urostomies, the bag will be equipped with a tap and the possibility to connect to a bed or leg bag and check valve to prevent the urine from backing up towards the stoma. This will prevent the infiltration beneath the adhesive and the risk of retrograde infection of the urinary tract.

A good pouch should have very specific characteristics: the adhesive should be attached safely and securely for as long as necessary, respect the skin, be gentle and remove easily: the filter should be odor-proof and does not allow waste products excreted to exit: the polyethylene film should be covered with non-woven cloth in order not to irritate the skin with which it comes into contact.

The adhesive, both in the one-piece and two-piece system bags, can be flat or convex: the correct choice of convex adhesive (for use in case of an introverted stoma or placed under the skin plane) can prevent or treat peristomal skin infections.

Peristomal skin infections

The peristomal skin should appear healthy and intact. When you observe a change it is necessary to gather detailed clinical history and perform an assessment to identify the etiology of the damage arising. Universally accepted rating scales for the staging of peristomal skin disorders do not exist in literature. Italian research groups, S.A.C.S. and the international OSTOMY SKIN TOOL have designed assessment tools for peristomal skin complications.

S.A.C.S. (STUDY ON PERISTOMAL SKIN LESIONS): It was developed in 2006/2007 by an Italian team of seven ETs and four surgeons: a system based on the severity of injuries and their location in relation to the stoma site was proposed. It includes five items describing peristomal skin condition: hyperemia, erosions, ulcerations, necrosis, proliferative situations, and five possible locations: four quadrants, such as in the breast, and the total in case of multiple locations.

OSTOMY SKIN TOOL: This tool was developed in 2008 by an international group of ET experts and referent dermatologists who have worked in collaboration with a manufacturer of ostomy aids. This tool is based on clinical observation concerning the presence of any lesions in the peristomal area: the presence and severity of lesions is classified into three areas: cutaneous discoloration, erosion, and hyperplasia of the tissue. Each of the six observations can report the score of 0, 1 or 2. A single final value is calculated by adding the scores of individual areas which then constitute the basis for implementing an algorithm of diagnosis. This assessment methodology allows reliable detection and allows the quantitative monitoring of treatment efficacy.

Changes in skin integrity

Amongst the complications of the stomatal complex, (which includes the stoma, the junction of the mucocutaneous zone and peristomal skin), changes in skin integrity are by far the most frequent, estimated from literature in a percentage varying from 10% to 70%. This is in turn responsible for a poor quality of life of patients to whom it causes severe pain, depression and increased operating costs of the stoma. The symptoms include itching, erythema that does not recede.
to fingertip pressure, the appearance of blisters, that may develop into erosion, serous fluid, fungal or pyogenic possible overlapping, until ulcerative lesions with the bottom affected by fibrin, biofilm or necrosis.

Alterations in skin integrity can be determined by:

— **malposition**: when the stoma is situated in places that render management manoeuvers difficult or impossible due to an incorrect or non-preoperative assessment;

— **trauma**: lesions from tearing of the adhesive related to the mechanical action detrimental to the skin (Figure 18). For their treatment eliminate the cause of the problem and treat wounds with hydrocolloid powder to absorb exudate, the hydrocolloid paste which contains no alcohol and/or hydrocolloid dressings before application of the pouch.

— **contamination due to contact with excrement**: caused by the detrimental action of effluent in contact with the peristomal skin (Figure 19) or from using harsh detergents or antiseptics. In this case, remove the irritant, use the powder and the protective hydrocolloid paste, take note of the size of the hole and use a pouch with a convex baseplate and band on the adhesive.

**The peristomal skin should appear healthy and intact, normothermic and normochromic.**

**In the event of contamination due to contact with excrement, it is better to remove the irritant, use the protective hydrocolloid paste and powder, take note of the size of the hole and use a pouch with a convex baseplate and band on the adhesive.**

Skin lesions caused by contamination from the gastrointestinal juices in gastrosomies and jejunostomies are also very important (Figure 20). In these cases, consider the possibility of replacing the pouch in addition to the skin care. For lesions from contact with effluent acids, acid-resistant solution compresses are useful. These are commonly taken orally in order to decrease the gastric acidity;

— **pseudoverrucose lesions** are part of the lesions from contamination, due to
Pathologies of the stomatal complex related to surgical problems (mucocutaneous suture dehiscence)

Occasionally, the mucocutaneous suturing of the stoma may not consolidate correctly; therefore dehiscence is experienced (Figure 21). Management of excrement then becomes very problematic, as it is still essential to implement the pouch; in fact, left free, feces and urine would fill the peristomal lesion, aggravating the problem, while contact with the skin could also cause disease.

In order to take care of the gap between the skin and the stomatal mucous membrane, it is recommended to stop using calcium alginate or hydrofiber, which should then be covered with hydrocolloid paste and a convex baseplate.

Systemic antibiotics are rarely required and it is recommended to identify the type of microorganism responsible for the colonisation before starting the treatment.

Systemic diseases that may affect peristomal skin integrity

Psoriasis

In the event of psoriasis with manifestations on the peristomal skin, avoid the use of creams and ointments, even where the application of topical cortisones is recom-

Sensitivity to components of the prosthesis

They are quite rare and almost always caused by contact, not so much with hydrocolloids, which make up 99% of the adhesives for ostomy bags, but rather with substances that are part of the ingredients of the adhesive hydrocolloid. To remove the allergenic or irritant factor, it is necessary to replace the brand of pouch in use with another one from a different manufacturer since not all companies use the same ingredients in the manufacture of the adhesives therefore, there is a hydrocolloid suited to the patient's skin type. Alternatively pouches with an adhesive other than hydrocolloid may be used, but these are not easy to find on the market.

On the skin, the use of cortisone-based products is possible, considering that the occlusion under the baseplate enhances the activity of the cortisone and, if the therapy were to be of long duration, the use of cortisone could lead to skin atrophy. Cortisone therapy may also be prescribed systemically.

It should also be noted that products with an oily residue in the ointment as well as in creams, may interfere with adhesion of the collection device.

Fungal superinfections

Fungal superinfections can occur on the peristomal skin. In such cases the use of an antifungal medicine via oral, parenteral or topical powder means is indicated.

The blood glucose levels of patients with diabetes mellitus should also be checked.

contact with waste products excreted, especially with urine. For the management of such lesions include the use of a device convex, check that the opening of the baseplate is not larger than the stoma, check urinary pH to define the acidity and, before applying the Silver nitrate to treat hyperplasia around the stoma, use a compress soaked in water and vinegar (20 min, 2 or 3 times per day).

Sensitivity to components of the prosthesis

They are quite rare and almost always caused by contact, not so much with hydrocolloids, which make up 99% of the adhesives for ostomy bags, but rather with substances that are part of the ingredients of the adhesive hydrocolloid. To remove the allergenic or irritant factor, it is necessary to replace of the brand of pouch in use with another one from a different manufacturer since not all companies use the same ingredients in the manufacture of the adhesives therefore, there is a hydrocolloid suited to the patient's skin type. Alternatively pouches with an adhesive other than hydrocolloid may be used, but these are not easy to find on the market.

On the skin, the use of cortisone-based products is possible, considering that the occlusion under the baseplate enhances the activity of the cortisone and, if the therapy were to be of long duration, the use of cortisone could lead to skin atrophy. Cortisone therapy may also be prescribed systemically.

It should also be noted that products with an oily residue in the ointment as well as in creams, may interfere with adhesion of the collection device.

Fungal superinfections

Fungal superinfections can occur on the peristomal skin. In such cases the use of an antifungal medicine via oral, parenteral or topical powder means is indicated.

The blood glucose levels of patients with diabetes mellitus should also be checked.

Pathologies of the stomatal complex related to surgical problems (mucocutaneous suture dehiscence)

Occasionally, the mucocutaneous suturing of the stoma may not consolidate correctly; therefore dehiscence is experienced (Figure 21). Management of excrement then becomes very problematic, as it is still essential to implement the pouch; in fact, left free, feces and urine would fill the peristomal lesion, aggravating the problem, while contact with the skin could also cause disease.

In order to take care of the gap between the skin and the stomatal mucous membrane, it is recommended to stop using calcium alginate or hydrofiber, which should then be covered with hydrocolloid paste and a convex baseplate.

Systemic antibiotics are rarely required and it is recommended to identify the type of microorganism responsible for the colonisation before starting the treatment.

Systemic diseases that may affect peristomal skin integrity

Psoriasis

In the event of psoriasis with manifestations on the peristomal skin, avoid the use of creams and ointments, even where the application of topical cortisones is recom-

Figure 21.—Stomal dehiscence.
The term “periwound skin” refers to the 8-10 cm area of skin around the edge of a skin lesion. The clinical characteristics of the surrounding skin are very important in the diagnostic approach of ulceration, so much so that in 1984, G. L. Stevenson argued that “the periwound skin is often much more important in the diagnosis of the ulcer itself”.

**Characteristics of periwound skin**

Upon close assessment of the periwound skin, it is possible to find out specific characteristics related to the etiology of the lesion (Table V).

Table V.—*Characteristics of the periwound skin and etiologic orientation*

| Edema, eczema, scar areas, purplish/brown discoloration, sclerosis of the subcutaneous   | Venous ulcer                      |
| Skin pale, dehydrated, frigid, low adnexa                                              | Arterial ulcer                     |
| Hypoesthesia / paraesthesia, sclerosis of the subcutaneous tissue, hyperkeratosis      | Peripheral neuropathy              |
| Jagged edges, periwound edema with intense purplish colour, cellulite                  | Pyoderma gangrenosum               |
| Palpable purpura or non-palpable purpura associated with petechiae, possible presence of nodules and vesicles, intense perilesional erythema | Vasculitis                         |

In more severe cases, for ulcerated lesions, consider the use of technologically advanced dressings such as calcium alginates or hydrofiber, basing wound-care on the principles of TIME. In the event of folliculitis, it is appropriate to avoid shaving.

The correct management of periwound skin can preserve the hydro-lipid film as well as the newly formed epithelium at the epithelialisation edge. It can also improve the quality of life of the person, by caring for the psychological aspect linked with the pain.
The periwound skin may appear intact, erythematous, pale/cyanotic, edematous, macerated, xerotic. All these features have already been discussed above; however, remember that there is also a particular form of skin thickening called “lichenification” (Figure 22). Lichenification is thickened skin, greyish in colour, often scaly; it is a hyperplasia of the epidermis with fibroplasia of the superficial dermis. Often secondary to pruritic dermatoses that causes chronic scratching. It may also occur in areas subjected to pressure/rubbing in response to an irritating stimulus.

**Figure 22.**—Lichenified and lesioned skin.

The periwound skin is very sensitive area of the skin because it is subject to various stresses owing to often aggressive exudation, traction (removal of dressings), persistence of residues more often than not from adhesive dressings glue, and often the overlapping layers of fatty substances due to lack of attention in the cleansing between one change of dressing and the other.

It is essential to carefully assess:

— cutaneous tropism and adnexa state;
— changes in color;
— temperature;
— state of hydration;
— any changes in dermatitic type;
— presence or absence of edema;
— possible areas of sclerotic.

Alterations of cutaneous trophism (dystrophy/atrophy) resulting from an inadequate nutritional status of the skin that may be due to malnutrition or lack of vascularization. In both cases, surgery cannot be local, but rather should be general, either pharmacological and/or surgical to ensure blood supply, or nutritional and supportive in order to allow the right amount of essential nutrients. An adequate intake of fluids to hydrate the skin and mucous membranes is also essential.

Color changes can occur due to hemosiderin deposition in the subcutaneous tissue (in the case of phlebostatic lesions - Figure 23), or the hypoxic state (cyanosis/ischemia), or inflammatory conditions (erythema - Figure 24).

**Figure 23.**—Hemosiderinic pigmentation (static IV ulceration).

The temperature may be indicator of inflammatory status (increased) or hypoxic state (low).

Optimal hydration is vital to preserve the barrier function of skin, as well as its ability to withstand trauma and external agents that can attack it. Dryness is a result of a reduction in the degree of oiliness from the sebaceous glands activities, and their malfunction may cause alteration of the physiological protection exercised by the hydro-lipid film, exposing the skin to irritation and infection.
Edema, particularly if of lymphatic origins (phlebolymphedema) presents periwound skin with a verrucous aspect and this is frequently observed at the edges of phlebotatic ulceration. This is indicative of destruction of lymphoid tissue due to repeated infections and persistent edema, together with sclerosis of the surrounding tissues (Figure 25).

Sclerosis is due to a resorption of the subcutaneous fat and a consequent hardening of dermal collagen. Sclerosis may be the cause of recurrent ulcers or repair of defects.

**Treatment of periwound skin**

Given that, just as with the treatment of healthy skin, there are also numerous products on the market for the care of periwound skin, what is truly important when selecting a treatment is to reach a sensible decision based primarily on the state of the periwound skin itself, and the behaviour of the lesion.

The periwound skin may appear:
- unharmed: meaning that the lesion is best managed, with good control of exudate and good performance of dressings. In this case, maintenance through means of a proper cleansing at each dressing change, and the maintenance of adequate hydration is important. We can then use detergent solution with low local aggressiveness and moisturizing fatty/oily solutions that preserve the natural moisturizing factor (NMF);
- xerotic: superabsorbent medications used for prolonged periods, whilst contributing to the good management of the lesion, may create an excessive drying of periwound skin. In this case, it is important to restore the correct hydration to prevent hydro-lipidic film depletion, typical of xerotic skin, leading to “non-protection” of the skin and thus causing irritative inflammation, as well as predisposition to bacterial aggression. In these cases, the use of adhesive dressings is not advised since using moisturising products (containing fats and oils) renders their adhesive properties difficult. Barrier products (creams and films) are obviously not recommended in order to prevent further drying. Before applying any product on the skin, it is recommended to cleanse the skin gently with specific products (as explained earlier in the chapter “Healthy Skin Management”), not with aggressive saline solution or antiseptic solutions. It is not uncommon to find dried flakes and crust formations on the xerotic periwound

![Figure 24.—Perilesional erythema from phlogistic state.](image1)

![Figure 25.—Verrucose appearance of the perilesional skin in phlebolymphedema.](image2)
— inflamed/infected: there are many stimuli that can cause erythema of periwound skin. The dressing materials can cause allergies resulting in erythematous and edematous of periwound tissue; critical colonization of a lesion causes an erythematous halo that increases considerably when the antiseptic treatment is not effective, the infection status is propagated to the periwound soft tissues; severe infection, which has then become involved in the tissue surrounding the ulcer shows a visible inflammatory halo with an “orange peel” appearance, called cellulitis, typical of infection; periwound edema is usually coupled with inflammation/infection, and therefore the causes of inflammation/infection will cause edematous periwound skin to appear. It is evident that all the possible treatments will aid the reduction of the inflammatory state/infectious lesion, with the consequent improvement of periwound skin; the topical treatment, only as a support, involves the use of antiphlogistic preparations as well as the occasional use of steroid preparations, preferably low-dose and/or “diluted” with a cream base on wet skin.

In case of lesions, whether micro- or macro-lesions, is essential for proper treatment, refer to the previous treatment, setting treatments that will help the healing, but that are appropriate to the local state of periwound skin.
Periwound skin and pain

There is no doubt that the state of the periwound skin influences the feeling of pain in the patient, but we cannot attribute pain only to the periwound skin; we must not forget that the edge of the lesion is strongly algogenic, but it may not be considered as part of the periwound skin: the bottom and the edge form part of the lesion itself. It is equally obvious that it is not only the lesion sending pain stimuli; inflammatory and edematous area, possibly with surface erosion from maceration, is definitely algogenic, both because the de-epithelialisation uncovers the superficial nerve endings, and because the inflammation itself is responsible for the movement of chemical mediators (bradykinin and kallikrein) appointed at the genesis of the pain through mechanisms of vasodilation and degranulation of mast cells. It is not for us to provide guidelines on the pharmacological treatment of pain: this document is aimed at correct management of periwound skin, “correct” meaning the congruous use of topical treatments designed to remove possible algogenic stimuli and the careful treatment of the lesion, understood to mean the application/removal of dressings. It is for this reason that it should be kept in mind that creams/gels containing anaesthetics are not recommended in the analgesic treatment of periwound skin for two fundamental reasons: creams can cause maceration and therefore worsen the pain as soon as the anaesthetic finishes while the gels, for those more than 70% water-based, tend to dry rather quickly with consequent new algogenic stimuli. Remember that the majority of dressings retain the wound fluids that are hydrophobic and therefore soaking the dressing to be removed is only a “psychological intervention”, often requested by the patient. It is obvious that washing may follow the removal of the dressing even though, according to the ETRS Guidelines (II ETRS Export Meeting - Berlin, June 2003), is not always necessary to wash the wound. However, it is essential to always keep in mind that adhesive dressings should only be used on undamaged periwound skin and that they should be removed with tangential traction and not perpendicular. Particular attention should also be paid to plasters that can cause bleeding lesions upon removal: there are specific products to be used for the removal of overly aggressive adhesives, but caution in their use is imperative since they contain solvent solutions. Ethers and solvent free solutions only are advised.

MANAGEMENT OF ACUTE SKIN WOUNDS

The surgical wound is often the primary cause of the onset of chronic skin lesions. In fact, with the exception of naturally occurring lesions (e.g., neoplastic lesions), for the most part a mechanical act is necessary to determine the continuity solution of the skin lining.

Notwithstanding the local and general factors that can compromise the healing process (and whose treatment goes beyond the end of this document), the evaluation of acute lesion characteristics may help in the preventing them becoming chronic as well as planning treatment of those that have already become chronic.

Classification of acute wounds

Acute Traumatic Wounds

Definition.—The wound is a “continuous” solution of the skin produced artificially by sharp or traumatic “means” (Figure 28).

Depending on the cause and appearance of the lesion, it can be distinguished as follows:
— linear wound: caused by a sharp cutting instrument, characterized by crisp and continuous edges, with no signs of tissue damage;
— contused wounds: caused by cutting instruments but in association with a pressure higher than endovascular; resulting in damaged ischemic tissue adjacent to the wound, to which the edges appear ecchymotic and susceptible to widespread necrosis or fragmented;
— tear wounds: caused by many different damaging agents. The edges are slightly frayed and irregular thickness. May be associated with tissue loss.

*Acute burn wounds*

*Definition.*—Lesions of the skin and deeper tissues caused by heat or electrical current or chemicals (Figure 29).

Burns should be considered traumatic lesions with particular characteristics that make them in a way similar to chronic lesions:
— loss of tissue, more or less extensive (depending on size and depth): This involves the disruption of the integrity of the skin covering, with impairment of related functions (thermal regulation, protection from infections);
— high risk of infection;
— pain (with the exception of third degree burns and charring, in which tissue destruction is likely to compromise nerve fibres and even interrupt the afferent nociceptor).

Leaving aside the trauma that can be associated with burns itself (inhalation lesions, burst fractures) and the specific and appropriate treatment (surgical debridement, wound therapeutics, drugs) periwound skin should be managed according to the principles set out for chronic lesions.

Avoid excessive evaporation from the lesion and the surrounding tissue. The area concerned should always be kept covered and protected to try to maintain the adequate moisture necessary to promote the healing process and minimize heat loss.

Decrease the risk of infection by reducing the exposure time to air (sterile cover of the lesion and surrounding skin). It is recommended to always use sterile equipment.

Minimize mechanical stresses that can evoke pain (friction, use of adhesives).
Contaminated
— secondary to trauma, open wounds
— contamination by spreading of the contents the gastro-intestinal
— interventions on the urogenital or biliary tract with the presence of infected urine or bile
— presence of an acute inflammatory process but not purulent
— significant disruption of aseptic procedures

Soiled
— secondary to trauma in the presence of devitalized tissue, foreign bodies, faecal contamination, soiled and / or long-standing wounds
— visceral perforation
— presence of an acute purulent inflammation.

It is widely demonstrated that infections are associated with the type of intervention, stratified according to the following percentage breakdown:
— clean interventions: 1-5% risk of infection;
— clean-contaminated interventions: 2-5%;
— contaminated interventions: 5-18%;
— soiled interventions: 20-30%.

Prevention measures to reduce the risk of infection.

Preventative measures mean any behavioural measures or healthcare aimed at the prevention of surgical site infections. As a reference standard guidelines for the prevention of surgical site infections were selected in 1999 issued by the Center for Disease Control and Prevention (CDC) in Atlanta and adopted in many countries of the world. These guidelines represent the indispensable foundation for the containment of perioperative infectious complications. It is further reiterated that antibiotic prophylaxis accompanies and completes preventative measures but does not replace them.
To minimize the risk of infection in surgical interventions, there are three fundamental moments during surgical procedures:

— before: adequate patient preparation and antisepsis of operators;
— during: coded behaviors for operators and measures to reduce environmental risk;
— after: behavioral instructions after surgery.

Let's recap only the points related to the management of the skin:

**Preoperative recommendations**

Patient

— identify and treat infections remote from the surgical site
— trichotomy before surgery is appropriate only when the hair interferes with the surgery. It should be carried out near the intervention, with disposable instruments and avoiding trauma to the skin.
— It is recommended that you shower the evening before surgery, immediately after hair removal using an antiseptic. Paying attention to the site of surgery, the umbilical region, genitals, armpits and between the spaces between the toes. If the patient is not self-sufficient staff should provide and ensure such procedure

Medical personnel

— Nails short, removal of rings and bracelets
— Wash hands and forearms correctly

**Intraoperative recommendations**

— Wear required protective clothing

**Postoperative recommendations**

— Adopt all necessary behaviours by operators along with measures to reduce environmental risk

**Surgical site infection definition criteria**

Infections from the surgical site represent the second lesion, in order of frequency and are subdividable in: superficial surgical site infection (SSI); deep SSI; organ or space SSI. Those being taken into consideration are superficial and deep infections

**Superficial SSI.**

The infection presents itself around thirty days after surgery and only concerns the skin or the subcutaneous tissue. In order to define a superficial SSI it is necessary to check one of the following conditions:

— oozing of suppurating material from the superficial portion of the surgical wound, with or without laboratory confirmation;
— isolation of cultured micro-organisms (obtained esthetically) from liquid or tissue from the seat of the incision; at least from the following conditions:
— spontaneous pain or pain resulting from pressure;
— localised tumefaction;
— irritation;
— heat;
— intentional reopening of the wound by the surgeon (the culture must be positive);
— diagnosis of superficial infection of the wound formulated by the attending surgeon or doctor.
potential pathogen agent and the environment; it occurs when the micro-organism is able to successfully break free from the defence strategies of the host, causing harmful alterations in the host himself.

Early signs of infection

It is fundamental to research and identify early signs of infection. The Delfi method which was developed for the first time in the 1950s and is a practical method to develop a concordant opinion based on the response of a group of experts.

A recent Delphi study produced a list of criteria which were selected by a panel for the evaluation of acute wounds as important indicators for SSI in the wound during recovery as a primary intention.

Delphi method

The criteria indicated are applicable to all types of surgical wounds. When examining the results of the Delphi study, the following observations raised a number of important questions linked to the early diagnosis of an SSI. It is of fundamental importance to divide the acute primary wound from the acute secondary wound

Cellulite, malodour, pain, delay in recovery or deterioration/degeneration of the wound represented by common infection criteria for all types of lesion. Criteria classified with a high score

Infection of the wound

The infection results from the dynamic interaction between the host, a

Deep SSI

The infection presents itself within thirty days from the surgical operation, without prosthetic implantation, or within a year, with prosthetic implantation; and is correlated to the surgery and involves deep soft tissues (for example adjacent fascia and muscle tissue) - Figure 31). It should also present at least one of the following conditions:

— ooze of suppurating material from the deep portion of the wound but not of the organs/spaces close the surgical area;
— spontaneous dehiscence of the deep site of the wound or the intentional reopening by the surgeon when one of the following symptoms presents itself:
  - fever >38 °C;
  - spontaneous localised pain;
  - pain caused by pressure to the site (with positive culture);
  - evidence of an abscess or other sign of infection during the direct examination;
  - during reoperation, by means of a histopathological or radiological examination;
  - diagnosis of deep-seated infection in the wound formulated by the attending surgeon or doctor.

Infection of the wound

The infection results from the dynamic interaction between the host, a

**An infection which involves both the superficial section and the deep-seated section of the wound is defined as being a deep-seated infection.**

**The capacity of a micro-organism to cause disease is indicated by its pathogenicity and by its virulence.**
Recognition of an erythema, defined as infection, has shown an increase in the marked SSI. Critical re-examination by the literature carried out by Reilly has shown that in many studies, if the definition is only limited to a “purulent secretion”, the incidence of infection is between 1% and 5%. Thus, where the criteria “erythema” or “cellulite” are found, the incidence of infection is from 6-17%.

Purulent exudation

It is widely accepted that the presence of pus and/or abscesses or of purulent secretion indicates the presence of infection (Figure 34).

It is interesting to note that the Delphi study panel for acute wounds indicated the criteria “purulent fluid exudation” and “purulent hematic exudation” as important indicators of infection (average score 6 or 7). The secretion provoked by an infection is more commonly presented between 5 and 10 after the operation, even though any secretion appearing from a surgical wound 48 hours after suture should be a cause for concern and requires further investigation.

Erythema

Painful rash diffused around the wound (Figure 33).

Inclusion of a rash and swelling may often appear around a wound for other reasons such as:
1. the normal swelling linked to the process of recovery;
2. the removal of some form of medication;
3. an allergy to medication;
4. clothes which are too tight;
5. to a seroma or hematoma.

Cellulite

An infection diffused on the skin and in the subcutaneous tissues, characterised by local pain, irritation, edema and erythema (Figure 32). The criteria “cellulite” and “pus/abscess” have been identified by the Delphi study as being the most important (classified 8-9) and can be considered diagnostic for infection.

Malodour

It is not clear how important this criterion is for the identification of an SSI and such

**Table VI.—Subdivision of the acute wound.**

<table>
<thead>
<tr>
<th>Acute primary wounds</th>
<th>Acute secondary wounds</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cellulite</td>
<td>Cellulite</td>
</tr>
<tr>
<td>Pus/abscess</td>
<td>Pus/abscess</td>
</tr>
<tr>
<td>Delay in recovery</td>
<td>Delay in recovery</td>
</tr>
<tr>
<td>Erythema + induration</td>
<td>Erythema + induration</td>
</tr>
<tr>
<td>Purulent hematic exudation</td>
<td>Purulent hematic exudation</td>
</tr>
<tr>
<td>Malodour</td>
<td>Malodour</td>
</tr>
<tr>
<td>Purulent fluid exudation</td>
<td>Pocketing</td>
</tr>
<tr>
<td>Degeneration/expansion of the wound</td>
<td>Purulent fluid exudation</td>
</tr>
</tbody>
</table>

Increase in local skin temperature

Edema

Fluid exudation with erythema

Swelling with an increased volume of exudation

Pain/unexpected inflammation

**HIGH LEVEL:** AVERAGE SCORE 8 or 9

**MEDIUM LEVEL:** AVERAGE SCORE 6 or 7

**LOW LEVEL:** AVERAGE SCORE 4 or 5
Necessary factors for a normal recovery of the wound

The correct and adequate healing of the wound is hindered by a potential conjunction of protein and vitamin deficiency, diabetes mellitus, obesity and infection. Besides this, there are systemic factors such as systemic infections (TB, syphilis) circulatory system conditions (atherosclerosis), blood disorders (anaemia) alterations in the nutritional state caused by metabolic disorders, assumption of corticosteroids.

Local factors

They can be distinguished by:

1. **humidity**: open wounds heal much more slowly when the epithelial cells, due to a low humidity level, migrate under the Escher, slowing the reepithelialisation process. If, on the contrary, the wound remains covered, with the correct medication, the higher humidity level is stable, allowing the

| It is important to use medication which encourages rapid healing. |
| Operated patients should not be exposed to low temperatures postoperation. |
epithelial cells to migrate more quickly to the surface, encouraging more rapid healing. This highlights the importance of the use of medication which encourages rapid healing;

2. **temperature**: temperature affects the healing of wounds. In fact, conditions of hypothermia determine a delay in the epithelialization process. The importance of operated patients not being exposed to low temperatures post operation should be underlined.

3. **oxygenation**: it is widely demonstrated that a high level of oxygen encourages the healing of wounds. If it is true that the overall majority of oxygen comes from the vascular bed, it is also true to say that good oxygenation from the environment encourages the same gas exchanges as previously mentioned. The importance of the use of semipermeable medication should also be highlighted.

**HEALED SKIN AND ITS COMPLICATIONS: HYPERTROPHIC AND KELOID HEALING**

**Healing of the wound**

The healing of the wound is a very complex process in which different cell types interact with the microenvironment.

This occurs because of:

- **re-epithelialisation**: an increase in the mitosis of keratinocytes, with restitution in integrum without aesthetic consequences;
- **healing**: is prolonged for about 1-2 years and differentiates in the initial inflammatory phase (tissue cleansing), a second proliferation phase (granulation tissue) and a third maturational phase (definitive healing).
- **contraction**: transformation of the fibroblasts into myofibroblasts, with the approaching of the wound’s edges, reduction of the risk of infection and to significant aesthetic damage.

The granulation tissue which forms during the proliferative phase has the task of filling between the tissues due to the wound. Progressively then the granulation tissue, through which there is a decrease in concentration of cells and vessels, evolves into scar tissue. This, being formed by collagen, elastin and proteoglycans, presents a composition similar to that of connective dermal tissue. However, in the scar tissue there is a predominance of type III collagen with respect to the type 1 found in dermal tissue: as well as this, in scars, with respect to dermal connective tissue, the collagen fibres are finer and appear to be organised in thin layers which are tightly crammed and irregularly orientated. For this reason, scar tissue appears to be less elastic and resistant to pulling than the normal dermis.

**Determining factors for pathological healing**

Over time, a number of classifications have been proposed with regard to scars based on the clinical characteristics of the same. Magliacani subdivides scars into: normotrophic, hypertrophic, retracting and atrophic; Amsler on the other had divides them into hypertrophic, keloid, atrophic, erythematous and pigmented.

There are many factors which can influence the healing process determining the constitution of a patho-
logic, hypertrophic or keloid scar. Amongst these the imbalance between synthesis and degradation in collagen appears to be fundamental. According to a number of studies, this imbalance can be attributed to the proliferation of an abnormal fibroblastic clone, which is less sensitive than normal myofibroblasts to stimulus inhibitors of proliferation, thus determining the excess production of collagen and consequently a pathological scar.

These fibroblasts are not normally present at the wound, but appear following the actions of a number of different factors, amongst which it would seem a genetic predisposition and or continuous stimulation of a traumatic nature of a variety of causes (chemical, physical, surgical, infective) in the wounded area. In any case for all pathological scars consideration should be taken with regard to their location as it has been seen that they are more frequent where the level of force is interrupted. (Langer). Table VII summarizes the main risk factors in the constitution of pathological, hypertrophic and keloid scars.

Hypertrophic and keloid scar

Hypertrophic scar

A scar which remains within the original limits of the wound. It usually presents itself in relief in respect to the cutaneous surface, of a hard consistency and very red, particularly if only recently formed (Figure 35). Clinically determined pruritus. After 15-20 months fibrous mass of the hypertrophic scar tends to reduce slowly and spontaneously, with an almost total disappearance of the highlighted scar area. The most common locations are: thorax, neck, upper limbs and postauricular area.

Keloid scar

A raised scar which extends outside the margins of the original wound into the surrounding tissues, over time taking on an appearance with increasingly irregular edges (Figure 36). Clinically it is characterised by the presence of pruritus and pain. Growth is continual and intermittent for months and years; there is an absence of significant regression and has a tendency to recur after ablation. It rarely leads to ulceration, whilst there are often small infected areas with draining fistula tracks, cutaneous bridges and pockets. In the early formation stages or during the growth period, the keloid tends to become a red-purple color and is taut. In the later stage and during the dormant stage the keloid is less dense and vascularized, but remains raised and firmer than normal tissue.

The keloid does not reduce spontaneously and tends to reduce easily when surgically removed.

Table VII.—Risk factors for the constitution of a pathological scar:

- Risk factors with regard to the constitution of hypertrophic and keloid scars
- Age: pediatric
- Sex: female
- Family history
- Race: African and Asian
- Anatomical location (thorax, neck, upper limbs, postauricular)
- Cause of wound (trauma, surgery, burn)
- Delay in wound recovery (complications, infection, local or systemic causes)
The keloid does not reduce spontaneously and tends to reduce easily when surgically removed. The most common areas affected are: head, neck, thorax, shoulders and upper limbs. It should be underlined that the greater density of wounds is in the median line of head, neck and chest. The keloid in those subjects who are predisposed can arise spontaneously or without any apparent cause.

Possibility of treatment of hypertrophic and keloid scars

Prevention

In subjects with a positive medical history with regard to the formation of pathological hypertrophic or keloid scars in general surgical treatment of an aesthetic nature is avoided.

Massage of the surgical scar is very useful, pushing the finger very energetically against the scar so as to see the skin whiten due to the compression and should be carried out every day for at least 20 minutes. Massage should be carried out “with a firm hand” using a specific cream for scars, such as a watery onion extract gel.

Between one massage and another, a protective, silicon based cream can be applied as well as other synthetic polymers such as polyurethane, which should be applied in a thin layer on top of the scar after massaging. The activating mechanism of these creams isn’t yet known and is sometimes in doubt: perhaps their efficiency is linked to a possible anti-inflammatory action of the silicone, or the change in the level of humidity of the surface, of the temperature or the oxygen tension in contact with the wound.

Useful preventative measures are: thin breathable layers of silicone: their actions seem due to compression on the wound, which determines a mechanical inhibition to hypertrophy and compressing the blood vessels, reduces the scar’s redness. Products available include cica-care®, sifravit®, mepiform®, epi-derm®, cica-care®, sifravit®, mepiform®, epi-derm®, which should be applied with their adhesive side to the scar. In order to keep the layers in place, it is recommended that they be fixed using a light adhesive bandage. The ideal time of application is for at least 12 hours a day for a period of three months. The silicone layers can be washed and used many times.

Conservative treatment

Conservative type treatments work whilst the scar is in the inflammatory phase and therefore between 6-18 months after its formation. Once this time is finished, if the scar is still ugly or raised, it is wise to consider surgical correction.

1. On already formed hypertrophic or keloid scars silicone gel based products may be applied or any other synthetic polymer such as polyurethane with the aim of obtaining the best possible appear-
3-5 infiltrations are carried out every 30-40 days. The most frequent complications are enlarging of the scar, excessive thinning of the skin and the development of thin superficial blood vessels (Telangiectasia), amongst the contraindications when using the drug, diabetes and hypertension should be listed.

4. Dye laser therapy (585 PDL) which selectively reacts with haemoglobin reducing the vascular component of the wound. Other lasers used for this are 1064 neodimio yag or even fractioned 1550 lasers, which favours the remodelling of the scar.

Surgery may use various methods, such as:

1. dermo-abrasion (cutaneous smoothing; which reduces superficial irregularities of stable and decreased thickness scars);
2. surgical drying using a cold scalpel followed by suturing;
3. surgical drying using a cold scal-
Cosmetic treatment

This is a technique to hide a stabilised scar, after other methods have not reached satisfactory results and is a medical tattoo. Examples are to tattoo the entire areola-nipple area after a mastectomy or to color a melanin scar.

Some patients choose to have a tattoo over the scar, with two aims: either to hide it or to “highlight” it and, therefore, show it with particular drawings.1-55

References


33. [No authors listed]. Evidence-based wound care standard in the clinical setting. Supplement to WOUNDS Sep 2007.


36. Linea Guida AIUC-ASiLeC per la gestione del dolore nel paziente con lesioni cutanee croniche. 2010


41. Dillon JM, Clarke JV, Emmerson S, Kintinmoment WHG. The jubilee method: a modern dressing design which reduces complications and is cost effective following total hip and knee arthroplasty. Poster presented at: American Academy of Orthopaedic Surgeons Annual Meeting; February 14-17, 2007; San Diego, CA, USA.


