CLINICAL MANAGEMENT

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An Introduction to Burn Care

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GENERAL PURPOSE:

The purpose of this learning activity is to provide an overview about burns and current burn care.

TARGET AUDIENCE:

This continuing education activity is intended for physicians, physician assistants, nurse practitioners, and nurses with an interest in skin and wound care.

LEARNING OBJECTIVES/OUTCOMES:

After completing this continuing education activity, you should be better able to:

1. List factors affecting the types, size, and depth of burns.

2. Propose first aid and treatment for various burns.

ABSTRACT

Burns are a very specific type of injury and, particularly in the case of large and/or deep lesions, require highly specialized care. This article gives a basic overview of burns and burn care and is not intended to discuss overall burn care in detail.

KEYWORDS: burns, burn care, burn center, lesions, referral, total body surface area, wound care

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INTRODUCTION

Burns are a very specific type of injury and, particularly in the case of large and/or deep lesions, require highly specialized care. In the US, the number of patients seeking medical care for a burn injury seems to be stable at approximately 500,000 per year.[1] Around 40,000 of these patients are hospitalized because of burn injuries, and 60% of those are treated in specialized burn centers.[1]

While small burns are the majority and usually not life threatening, larger burns, even partial-thickness ones, still pose a major

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threat when not treated properly. Small burns still may cause major morbidity, however, because the injury may be very painful and can lead to disfiguring outcomes such as hypertrophic scars, keloids, and contractures.[2]

This article gives a basic overview of burns and burn care and is not intended to discuss overall burn care in detail.

TYPES OF BURNS

Burns can be categorized as follows:[3]

• Scald injuries typically result in partial-thickness lesions when cooled quickly. The injury is caused by contact with a hot fluid such as hot tea or coffee.

• Flame injuries are caused by direct exposure to flames. House and car fires are common etiologies, and the burns usually are full-thickness.

• A flash burn may be caused by very short exposure to a burning gas or vapor. The lesion is often partial-thickness (unless, for instance clothing catches fire).

• Contact burns are caused by contact with a hot surface. In many cases, these injuries are not deep, although this depends on the temperature of the surface touched and the length of exposure. Major injuries may be caused by the combination of pressure and prolonged exposure to the heat source, as is the case in patients who, after an epileptic insult, remain in contact with a hot surface for a prolonged period.[4,5] On a hot day, asphalt can cause a second-degree burn in less than a minute.[6] Contact with hot coals, molten metal, and other high-temperature substances often leads to deep burns.

• Electrical burns are caused by contact with an electrical current or electricity strike. Electricity is converted to heat, leading to extensive and deep tissue necrosis that may initially be hidden to the naked eye. The amount of heat is proportional to the electrical resistance of the tissues and the amperage.[7] Electric burns often rapidly lead to systemic complications such as acidosis or myoglobinuria and renal failure, and compartment syndrome.[8]

• A radiation injury is caused by exposure to heat radiation (in contrast to ionizing radiation). These injuries are usually first degree; a typical example of this type of injury is a sunburn.

Not all lesions that are commonly treated in burn centers are burns in a true sense. Patients with frostbite; chemical injuries; and diseases such as toxic epidermal necrolysis, epidermolysis bullosa, and necrotizing fasciitis nowadays are often treated in burn units because their systemic complications and required surgical interventions can be similar to those of thermal injuries.[9–11]

Most chemical agents damage the skin by producing a chemical reaction rather than a hyperthermic injury,[12] and thus, chemical lesions are not burns in the literal sense. This type of injury may require special treatment copious irrigation with water is often a proper way to initiate treatment.[13] Specific treatment depends on the type of chemical causing the injury; hydrogen fluoride, for example, enters the human body via where it contacts it and can penetrate skin, nails, mucosa, alimentary and respiratory tracts, and ocular surfaces,[14] requiring treatment that focuses on the subcutaneous tissues and the (systemic) effects of absorption. Treatment may include compounds such as calcium gluconate gel or intra-arterial injections.[15]

Skin injuries caused by radiotherapy often also are called radiation burns.[16] Because of their pathophysiology, these lesions should be considered ulcers (chronic wounds)[17] rather than burns. Radiation injuries lead to changes in cytokine and metalloproteinase modulation and expression that are, indeed, much more similar to those seen in ulcerations.[16,18–22]

BURN SIZE

Morbidity and mortality of burn injuries are directly related to the size of the burn, whether an inhalation injury and/or other concomitant or preexisting diseases exist, and the general condition and age of the patient.[23] Superficial but large burns, particularly in older adults and young children, are sometimes associated with a high level of morbidity and mortality.

Most wound measurements express the size of a lesion in cm^2 (or in^2). The size of a burn, however, is expressed as a percentage of the total body surface area (TBSA). The rule of nines is used to calculate a rough estimate of the burn size:[24] the body is divided in areas of nine or multiples of 9%. Each leg and side of the trunk count for 18%, and the head and arms each count for 9%. The remaining 1% is reserved for the genitalia and the perineum.

In pediatric patients, these percentages are different: for example, in a neonate, the head counts for 18%. To determine the exact size of a burn, burn centers use much more specific charts based on the age of the patient;[24] corrections on these charts are necessary for (morbidly) obese patients.[25] An easy guideline is that the patient's palm represents 0.5% TBSA.[26] Still, without specific tools, accurate measurement of burn size is notoriously difficult for providers untrained in burn care.[27]

Sophisticated means for measuring TBSA are now available, using techniques such as three-dimensional computer modeling.[28–30] While generally speaking the accuracy of these methods is excellent, they are not yet fully established and/or widely used.

CONCOMITANT INJURIES OR MORBIDITIES

Major burns (ie, those exceeding 20%–25% TBSA in adults) are associated with a number of complications. A rapidly occurring change in capillary permeability causes massive fluid transfer from the circulation into the interstitium, which, when untreated, quickly leads to hypovolemic shock. To avoid this, patients with large burns initially receive large I.V. volumes of fluid to sustain sufficient circulation. The type and amount of fluid are calculated

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using specific formulas.[31,32] When capillary permeability has been restored, this fluid needs to be removed using forced diuresis.

The skin of an average-size male weighs in at around 20 pounds. Thus, a 50% TBSA full-thickness burn is associated with approximately 10 pounds of necrotic tissue. The amount of necrotic tissue and the reaction to heat exposure are directly responsible for systemic problems in large burns; this effect is known as burn disease.[33]

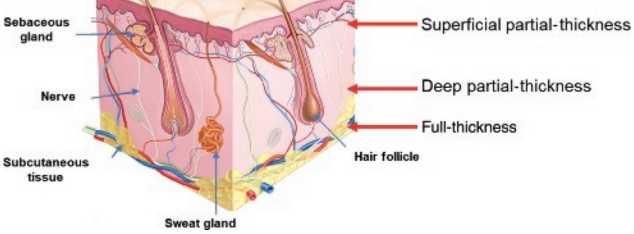
Infection and sepsis remain major risks[34,35] and cannot always be avoided.[36–38] A typical complication is systemic inflammatory response syndrome.[39] This serious condition is related to organ dysfunction and failure and systemic inflammation.[35,40] It is a subset of the cytokine storm, which is characterized by dysregulation of various cytokines.[41] It is also closely related to sepsis, in which patients satisfy criteria for systemic inflammatory response syndrome and have a suspected or proven infection.[41]

A specific serious complication that may accompany flame burns in particular is inhalation injury. Essentially, the inhalation of toxic and/or hot gases and fumes causes damage to the tracheal and pulmonary system.[42] This condition is associated with a high level of morbidity and mortality and often requires artificial ventilation.[43–45]

DEPTH OF BURNS

The depth classification of a burn is related to the anatomy of the skin (Figure 1). The basal membrane separates the epidermis from the dermis. The dermis contains epidermal structures such as sebaceous and sweat glands. Complete destruction of the epidermis and dermis renders re-epithelialization possible only from the wound edges. Re-epithelialization from the deeper, epidermal structures is possible, in principle, when these structures are still intact. Therefore, partial-thickness burns have a higher potential to heal spontaneously and without surgical intervention and do so more quickly than full-thickness burns.

Figure 1.
ANATOMY OF THE SKIN



Note the epidermal structures (hair follicles, sebaceous glands, sweat glands) deep in the dermis.

The location of a burn also may influence the depth of a burn because the thickness of the skin depends on the anatomical location on the body. Thicker skin can better resist a certain amount of thermal exposure: thus, a burn of the lower back, where the skin is thick, will be more superficial than the thin skin on the eyelids when exposed to the same amount of heat.

The depth of a burn is also related to the time of exposure and the temperature of the insulting mechanism. Therefore, as mentioned, contact burns are mostly superficial because the exposure time is very short. Scalding, on the other hand, rapidly leads to deep burns. Exposure to water with a temperature of 55° C for 25 seconds results in deep dermal or full-thickness burns, whereas a 2-second exposure to water at 65° C causes a similar injury.[46] Further, because of the much higher thermal capacity of water, a scald usually is deeper than a grease burn, despite the (often much) higher temperature of the grease.

Depth per se is not directly related to the level of morbidity or mortality (in contrast to size of the burn injury), but it determines whether surgical intervention is necessary.

A burn wound is an active wound with a particular physiology;[47] burns initially diagnosed as superficial partial-thickness burns have been known to deepen after a few days, known as conversion or secondary deepening.[48–50] On a cellular level, inadequate tissue perfusion, free radical damage, and systemic alterations in the cytokine milieu of patients[47–51] are part of the underlying etiology. These phenomena are the result of a number of events in and surrounding the wound such as impaired wound perfusion, infection, tissue desiccation, edema, a circumferential eschar, metabolic derangements, and older age.[52] Whatever the exact mechanisms, choosing the appropriate dressing plays an important role in the prevention of conversion in partial-thickness burns, although some burns may still convert.[53]

First-Degree Burns

Most sunburns are typical examples of a first-degree burn. The epidermis is not breached, but the lesion is painful and looks red because of the inflammatory response. Desquamation may occur after a couple of days. Small first-degree burns do not require any specific treatment; although many dressings have a formal indication for first-degree burns, the patient may benefit from the application of a soothing cream or ointment and some form of pain treatment instead.

Superficial Partial-Thickness Burns

In superficial second-degree burns, the epidermis is destroyed, and the lesion exposes superficial parts of the dermis. Blisters may or may not occur. The skin is hypersensitive to the touch, and the lesion is moist and pink in color underneath the blisters (Figure 2A). Capillary refill is almost immediate. Given appropriate treatment, this type of burn will heal with minimal scarring within 10 to 14 days.

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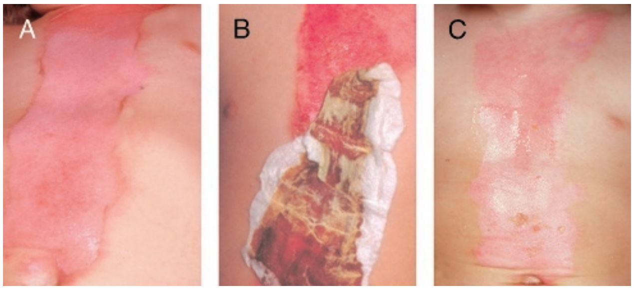
Figure 2.
SUPERFICIAL PARTIAL-THICKNESS BURN IN A TODDLER



A, Typical superficial partial-thickness scald in a toddler, postburn day 0. B, Treatment with a modern dressing. On the cranial side of the wound, the dressing "dislodged" from the wound, showing re-epithelialization underneath, postburn day 7. C, Complete re-epithelialization on postburn day 12. This wound is unlikely to develop hypertrophic scarring.

Deep Partial-Thickness Burns

In deep second-degree burns, the deep dermis is exposed because both the epidermis and the superficial dermis are destroyed. Visually, the lesion may mimic a superficial partial-thickness injury or a full-thickness injury. Capillary refill is slow or may not occur at all (Figure 3A). The amount of pain varies.

The exact depth of this type of burn may be very difficult to determine visually. Laser Doppler flowmetry (LDF) may assist in establishing a more accurate diagnosis. Because most deep-seated epidermal structures are destroyed, healing from deep structures is limited: healing may take significantly longer, and (late) surgical intervention may be warranted.

Full-Thickness Burns

In these burns, the wound surface is usually dry to the touch and leather-like. The color of the burn depends on the acting agent (Figure 4): a full-thickness scald is usually white, whereas a flame burn is often black because of the soot. The lesions are generally not painful, because the whole dermis and epidermis, including the nerve endings, have been destroyed. In most cases, excision and grafting are warranted.

Fourth-Degree Burns

In these burns, the entire skin is destroyed, and substantial thermal damage is evident in subcutaneous and deeper tissues. Extensive carbonization may be present in flame burns. This type of burn is also seen in patients exposed to a combination of prolonged pressure and a hot surface. Major reconstruction efforts with or without amputation are often necessary.

Depth Diagnosis

For a provider to make an accurate depth diagnosis, patient history is important, as is the mechanism of injury and the physical aspects of the burn. If, for example, the patient history indicates immediate cooling after a flash burn, chances are that the burn is not very deep, whereas exposure to flames will virtually always result in a full-thickness burn. If the patient history is not congruent with the injury, providers should suspect abuse, particularly when the patient is a young child; they should notify authorities and ensure the safety of the patient.

Even experienced burn physicians and nurses can misjudge the initial depth of a burn.[54] The level of skin blanching can help establish proper depth diagnosis because slow or absent refill indicates a deep lesion. Another method to assist in this determination is the pinprick test, in which the injured area is very gently probed with a sharp needle tip, and the patient self-assesses the intensity of his/her pain. Serious pain indicates a superficial burn. Minimal or no pain indicates a deep dermal or full-thickness burn.

Ultrasound also can be used to assess depth, but results may not be significantly different from clinical judgment,[55] although newer devices with higher levels of discrimination are currently being tested. Dyes such as fluorescein have been evaluated and can help make a distinction between nonnecrotic and necrotic tissue[56] but are not commonly used.

In experimental and clinical research, LDF was proven to provide a reliable depth diagnosis.[57,58] In general, LDF devices have become smaller, faster, and easier to use, making the technique more practical[59] and allowing for quick, accurate,

Figure 3.
MIXED PARTIAL-THICKNESS BURN IN A TODDLER

A, Typical mixed partial-thickness scald, postburn day 1. B, A fresh layer of SSD cream is in place, postburn day 5. C, Secondary deepening on a wide scale, postburn day 12. This burn now needs to be excised and grafted.

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Figure 4.
FULL-THICKNESS BURN

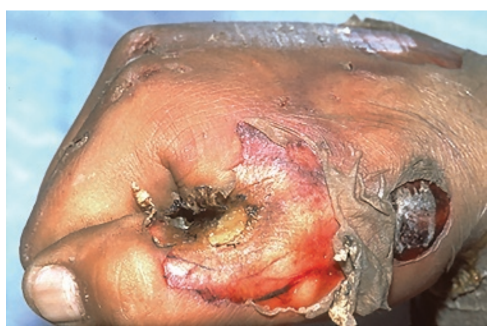
A small burn caused by contact with a hot motorcycle exhaust pipe, postburn day 0.

and rapid diagnosis over large surfaces.[58–61] Even more sophisticated techniques, such as the use of laser speckle contrast, are currently being investigated for the analysis of burn depth.[62]

FIRST AID AND GUIDELINES FOR REFERRAL

The simple measures that comprise initial care are essentially identical whether or not a patient is referred to a burn center.[3]
• For thermal and chemical injuries, immediate cooling is important because tissue temperatures greater than 45° C will exacerbate local injury.[63] Dissipating heat is the first step. Running tap water for a minimum of 10 minutes over the injury site helps reduce the initial pain,[64–66] decreases wound edema,[67] and decreases the risk of secondary deepening.[50,67] Water also helps to dilute any chemical agent; however, depending on the agent, additional measures may be necessary. Too much cooling carries the risk of hypothermia; patients, particularly children, should not be immersed in ice water.
• Rings may act as a tourniquet and have to be removed.
• Wounds may be gently cleaned using a soap with neutral pH. Some providers prefer chlorhexidine gluconate soap because of its antimicrobial effect against regular skin flora.[68]
• Tar and asphalt burns should be cooled first. If the causative agents stick to the skin, peeling them away may do additional mechanical harm to the skin; the use of a solvent is preferred.[69]
• Most chemical lesions may benefit from rinsing with water to dilute the agent. As previously stated, for many chemical agents, first aid is specific,[13,70–75] so providers must identify the chemical that caused the injury.
• Prior to transportation, clothing may be carefully removed; it may be stuck to the wound. Providers should use a nonadherent dressing to cover the burned areas. Silver sulfadiazine (SSD) or other creams should not be used if the patient is referred, because the cream will need to be removed upon arrival in the burn center to assess the wound aspect and size, and this can be painful. The creams, particularly SSD, may also change the visual aspect of the burn by creating a so-called "pseudo-eschar."[76] Further, many over-the-counter "burn creams" are contaminated within a relatively short time after opening their container.
• In larger burns, I.V. fluids are indicated prior to patient transport to a burn center if transportation is expected to take more than 60 minutes: this is necessary to provide circulatory volume support. Several resuscitation guidelines and regimens are used. Among them, the administration of lactated Ringer's solution, infused at 2 to 4 mL/kg per percent TBSA per 24 hours,[77] is one of the standards, but consult with the burn center in case a different regimen is preferred. If possible, I.V. access should not penetrate through burned skin and should be achieved using larger veins (central lines are preferable in patients with extensive burns).
• Opioids may be used as pain medication but may only be given intravenously; avoid other methods of administration because the pattern of uptake is unpredictable.
• If providers suspect an inhalation injury, 100% humidified oxygen should be administered during transportation. However, providers should first consult with the burn center to which the patient will be transported about possible intubation prior to putting the patient in the ambulance or helicopter. Inhalation injury should be suspected in patients with a cough, facial burns, or soot in the mouth or nostrils and/or when the patient is hoarse or wheezing.
• Headache, nausea, confusion, and vomiting are symptoms of carbon monoxide poisoning.[78] Admission for observation with humidified 100% oxygen, attentive pulmonary toilet, bronchodilators as needed, and prophylactic endotracheal intubation as indicated are the mainstays of treatment. Consult with the burn center to which the patient is referred.[79]
• Escharotomies may be needed in patients with circumferential deep burns that may restrict respiratory excursion of the chest, circulation into the limbs, and/or postburn intra-abdominal hypertension.[80–82] Consult guidelines from a burn center before performing an escharotomy.

Figure 5.
ELECTRICAL BURN



The extent of the injury underneath the skin is difficult to judge and needs to be explored.

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The American Burn Association has several helpful criteria for referral, including any burns that involve sensitive areas such as the face or major joints.[83] These can be viewed at http://ameriburn.org/wp-content/uploads/2017/05/burncenterreferralcriteria.pdf.

Some providers prefer patients with acute respiratory distress syndrome to be transported in a prone position, whereas others prefer a sitting position during transportation;[84] still others prefer transportation in a semisitting position, particularly when patients are intubated.[85] Before transporting a patient to a burn center, the center should be contacted to discuss general and specific treatment, transport methods, and necessary interventions.

TREATMENT

Mortality in burn care has dropped significantly during recent decades. Nowadays, survival of patients with full-thickness burns of more than 95% TBSA is not uncommon.[86,87] This may be attributed to better understanding of the physiology of burn disease and systemic responses, better prevention and management of complications, and more aggressive surgical approaches.

Smaller, partial-thickness burns that are fresh can easily be treated outside of a burn clinic with proper dressings. The dressing chosen should have a number of properties, including (but not limited to) keeping the wound moist, providing protection from infection, and reducing pain.[88,89] Ideally, dressing changes should be limited because these interventions may be painful and may damage the healing wound.

In the past, global surveys have shown that SSD was the most commonly and frequently used antimicrobial agent for the management of burns, including small partial-thickness burns;[90,91] this is probably still the case. There are a number of reasons, however, why this may not be justified for fresh, small, partial-thickness burns, including

- pseudoeschar, which makes judging burn depth difficult,[76]
- the need for frequent changes,[92]
- the potential for developing leukopenia,[93] and
- frequently observed delayed wound healing.[94]

Gauze dressings are also commonly used and associated with delayed healing, increased infection rates for burns and donor sites, and an increase in pain when compared with modern biologic and occlusive dressings.[90,94–102] Many proven dressings are available. If burns are fresh and small, the use of medicated creams is usually not necessary. Most importantly, if a burn is not healed within 10 to 14 postburn days, the initial depth diagnosis may have been incorrect, or conversion may have occurred (Figures 3A-C). The patient should be referred to a burn specialist because prolonged healing may lead to the formation of serious scars. This article does not recommend specific dressings; however, clinicians are encouraged to find information on properly tested materials with good outcomes from the published medical literature.

Full-thickness burns virtually always require excision and grafting, which should be performed by a specialist. Early excision is preferred[103–105] because it reduces a number of complications associated with necrosis. Several techniques can be used to close the resulting open wound, including straightforward autografting, with or without meshing and with or with an overlay of allograft in widely meshed autografts.[106–109] Other closure techniques can be used but are beyond the scope of this article. If excision and grafting are not possible because of serious comorbidities or additional extensive, nonthermal trauma, this in itself may be a reason for referral.

LONG-TERM RESULTS

The remodeling phase of wound healing involves reorganization of the extracellular matrix and is initiated after re-epithelialization is complete. The process may go awry, however, as the result of many biochemical processes that are involved in "improper" wound healing, among them a deregulation of a number of inflammatory mediators.[110,111] These mediators play a major role in the development of scarring complications[110] via a state of continuous and histologically localized inflammation,[112] which macroscopically results in hypertrophic scarring and the formation of contractures and/or keloids.

Hypertrophic Scars

Hypertrophic scars are red, inflamed, raised scars. They can be seriously debilitating and negatively impact patient quality of life because they may limit movement, can be painful, and are virtually always pruritic.[113] If scarring is visible or extensive, the psychological burden of being considered "ugly" and "scary" by society is important to note.[114]

Hypertrophic scarring is virtually certain to occur in burns that have taken a long time to heal spontaneously.[115] Scarring is also genetically determined: dark-skinned patients have a significantly higher risk of serious scarring.[2,116] Scarring also depends on other factors, such as the location of the wound. A sternotomy incision, for example, frequently results in a hypertrophic scar.[117]

During initial healing, not much can be done to prevent hypertrophic scarring. However, using dressings and techniques that are proven to reduce time to healing may indirectly reduce the incidence of these scars.[115] In patients who have a history of scarring, providers should take measures that lower the chance of hypertrophic scars, such as the use of (customized) pressure garments[118–121] with or without silicon sheeting as a contact layer on the wound.[122–124]

If a scar has developed, consider corticosteroid injections.[125,126] Other therapies are being developed, among them different types of lasers[127,128] and promising pharmacologic agents.[129] In a recent report, the use of 2,940-nm wavelength Er:YAG as a treatment

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for hypertrophic scarring was shown to lead to a high patient satisfaction with the outcome.[130]

However, treatment of hypertrophic scars is often not satisfactory, and visible scars may remain, although they will become flatter and less inflamed over time. Surgical scar revision may be necessary, particularly when scar formation leads to contractures.[131–133]

Keloids

Keloid formation is different from hypertrophic scarring, physiologically as well as macroscopically: a typical keloid extends beyond the borders of the original wound and has a cauliflower-type appearance.[134–136] Prevention and treatment of keloids are even more difficult than those of hypertrophic scarring[137–141] and are beyond the scope of this article.

Other Results

Contractures typically occur over joints, in the neck, and on the female breast and may lead to severe morbidity, requiring surgical reconstruction.[142–144] Preventive measures include splinting and physiotherapy, but success is not guaranteed; often, secondary reconstructive surgery may be needed.

A Marjolin ulcer may develop in a burn scar, particularly when part of the original lesion is not healing. These ulcers, commonly basal cell carcinomas, should be treated as a regular skin malignancy but are not always recognized as such.[145–148]

Other, non–skin-related postburn complications are not uncommon, such as heterotopic ossifications in periarticular tissue,[149] but are beyond the scope of this article.

SKIN DONOR SITES

Skin donor sites can be full- or partial-thickness and located virtually anywhere in the body.[150–152] Full-thickness donor sites are not common in primary burn management: the donor site itself must be covered with epithelium unless it is very small and can be primarily closed. Partial-thickness donor sites still contain deep-seated epithelial remnants, from which skin can regrow. A re-epithelialized donor site may be reharvested a number of times, although the quality of the skin diminishes over time.

In extensive burns, the scalp is often used because the site re-epithelializes rapidly and thus can be reharvested quickly and often,[150] although the use of this site in children with dark skin was recently shown to lead to a relatively high number of complications.[153] The skin quality of a donor site should resemble the skin of the recipient site as much as possible.

Donor sites themselves can cause considerable morbidity, primarily because they are very painful.[154–158] They may also present healing difficulties,[152] particularly in older adult patients with frail skin and in patients with large burns. In large burns, when no other locations are available, donor sites may also be surrounded by burned areas and thus become more prone to infection and present difficulty in dressing the wound.

Donor sites bleed profusely. Different hemostatic materials (eg, epinephrine and thrombin dressings) are often used in combination with, or prior to application of, a cover dressing. While superficial donor sites usually heal without serious scarring, some patients do develop hypertrophic scars.

Many different types of dressings are used to treat donor sites.[90] The same criteria apply for these dressings as those for partial-thickness burns.[88,89] Choose materials that help provide hemostasis and provide pain reduction and rapid healing to reduce short- and long-term morbidity.

CONCLUSIONS

The treatment of serious burns, donor sites, and related injuries and diseases should happen in a burn center. In these centers, interprofessional teams are dedicated to burn care, and their knowledge of the latest and most effective treatment options often leads to relatively satisfying results. Further, the physical structure of a burn center is specialized and may include advantages such as advanced temperature control to heat up patient rooms during dressing changes and a hierarchic treatment of air pressure using patient room entry locks.[159,160]

However, the large majority of patients with burns suffer from lesions that do not necessitate this high level of care. These lesions can be successfully treated outside in a general hospital or an outpatient clinic, provided that wound management is conducted in line with evidence-based burn care guidelines and with proper materials and techniques. Guidelines for referral[83] should be followed, and if a burn has not healed within 10 to 14 days, the patient should be referred to a specialist.

PRACTICE PEARLS

- Immediate cooling with running tap water for about 10 minutes is the best first aid.
- Superficial burns may become deeper secondarily; therefore, burns that take longer than 2 weeks to heal should be referred to a specialist, because they may very well have to be excised and grafted.
- Full-thickness burns, unless they are very small, should be excised and grafted unless there are specific contraindications.
- Particularly with flame burns, always be aware of the possibility of an inhalation injury and/or carbon monoxide poisoning.
- Short-term acceptable cosmetic outcome (ie, immediately after reepithelialization) does not guarantee patient satisfaction with long-term scars.

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