

# The Management of Burns

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## Management at the scene of accident (First Aid)

### 1- Stopping the fire:

This relies on the principle of the Triangle of Fire. To break the triangle you should sever one of its sides. The best way is to deprive it from oxygen using a blanket, sand or water irrigation. Never roll the burn victim on the ground which may guide the flames upwards along the sides of the victim's body.

### *Residual heat:*

The subcutaneous temperature continues to rise for a while even after the heat source have been removed; thereafter it takes about 3 minutes for the tissues exposed to return to body temperature and so heat damage is continuous. Continuous irrigation with water or a non-flammable fluid should continue for at least 10 minutes to achieve effective cooling and minimize damage caused by residual heat.

### *Role of water irrigation:*

- Flushes away any noxious chemical agents
- Reduces pain in affected areas (cooling effect)
- Minimizes onset of burn edema
- Rapid lowering of injured part temperature

### 2- Providing Resuscitation:

- A: Air Way
- B: Breathing
- C: Circulation

### 3- Relief of Pain:

Partial thickness burns experience pain due to exposed nerve endings while full thickness burns usually have damaged nerve endings and so pain is minimal. Pain is relieved by:

- a- Prompt cooling to less than 43° the threshold for cutaneous nerve endings.
- b- Exclusion of air in partial thickness burns by wound coverage.

### 4- Wound Coverage:

- To minimize pain
- To absorb exudates and debris
- To protect against infection during transport

### 5- Rapid transport to hospital

## Management at the Emergency Department

### 1- Resuscitation:

- A: Air Way
- B: Breathing
- C: Circulation

## **2- Pain Relief**

### **3- Burn Assessment:**

The potential for a fatal outcome is present from the moment excessive burn occurs, Hence the severity of burns is of utmost importance and is dependant of burn extent and depth.

#### ***Extent assessment***

The amount of body surface burned has a direct effect upon the outcome. Any patient with more than 50% of his Body Surface Area (BSA) burned is considered to have an extensive burn.

Extent of burn can be estimated using the **Wallace Rule of Nines** which indicates the percentage of total body area accounted for by various parts of the body; 9% for each of the arms & head , 18% for each of the lower limbs, front of trunk and back of the trunk and 1% for the perineum. The palmar surface of the hands accounts for 1%. Simple erythema should not be counted.

For a more accurate estimation, especially in children whose proportions are different from adult one; a **Lund & Browder chart** should be used which makes a more accurate allowance for the differences in body surface area with age and for the differences in burn depth inside the affected area(s).

#### ***Depth assessment***

The old classification as first, second and third degrees is inaccurate and replaced by the current classification:

#### **Superficial partial thickness burns(First degree burns)**

Only the epidermis is affected

Regeneration is rapid and complete

Example: Sunburns

Pink, moist, painful

Pin prick sensations intact

Never blisters

Not calculated in burn extent

#### **Deep partial thickness burns(second degree burns) .**

Epidermis & part of dermis damaged

Re-epithelialization occurs from remnants of hair follicles and sweat glands unless infection occurs

Analgesic

white, dry, less sensation

#### **Full thickness burns(third degree burns)**

Full thickness skin destruction

Re-epithelialization is difficult and slow from migration of epithelium from burn edges

Pin prick sensations lost

leathery

various colors

## **4- Escharotomy**

Circumferential burns that may constrict the chest leading to respiratory embarrassment or a limb interfering with the circulation need to undergo immediate escharotomy employing longitudinal full thickness skin incisions.

## **5- Criteria for admission into burn center:**

According to the American burn Association Burn Center Referral Criteria

### **A-Major Burns**

i-Superficial and deep dermal burns involving more than 10% BSA in patients younger than 10 or older than 50 years of age

ii-Superficial and deep dermal burns involving more than 20% BSA in any age

iii-Superficial and deep dermal burns with serious threat of functional or cosmetic impairment that involve:

Face Hand Feet Buttocks Perineum External genitalia Major joints

iv-Full thickness burns of more than 5% BSA

v-Electric burns

vi-Chemical burns

vii-Inhalation injury

### **Criteria of inhalation injury**

Closed space burns

Motor vehicle accident burns

Facial burns

Singed nasal hairs

Carbonaceous sputum

Carbonaceous particles in larynx

viii-Eye burns

ix-Crushing burns especially of hand and feet

x-Circumferential burns of the chest which may impair ventilation or of the limbs which may embarrass the circulation

### **B-Shock**

### **C-Concomitant mechanical injury or pre-existing medical illness**

## **6- Management of minor burns:**

Those burns are treated on an outpatient basis

### 1- Relief of pain by analgesics

### 2- Local wound management

- Exposure treatment (especially for the head & neck)
- Wound coverage
- Blisters act as a biological dressing. De-roofing should be avoided as it increase the possibility for infection and causes unnecessary pain and delay healing. If huge they may be aspirated
- Prevention of scar Hypertrophy (see later)
- Splintage (fingers burns and burns near joints should be splinted in the position of function to avoid contracture deformities)
- Chemical burns need thorough washing to remove all chemicals capable of producing sustained damage from prolonged skin contact

### 3- Antibiotics

The use of antibiotics is controversial in cases of minor burns provided that proper wound management is employed

## **Management at the Burn Unit**

### **1- Fluid & Electrolyte Replacement:**

Within minutes after burns edema begins to gather beneath damaged areas as a result of changes in capillary permeability and osmotic forces in the affected parts. Without proper treatment and with continued shift of fluids into burnt tissues, Hematocrit value starts to rise. Within 3-4 hours of extensive burns of more than 50% BSA without proper fluid replacement, one third of total blood volume may be lost and signs and symptoms of severe hypovolaemic shock start

### ***Crystalloids or Colloids***

Following a major burn, the volume shift of plasma into damaged tissues to form burn edema represents a large new plasma space . Resuscitation can be viewed as an attempt to expand the original plasma volume to permit the coexistence of this new space with the normal plasma volume. With extensive burns there is also increased permeability in the unburnt tissues but less marked than in the burnt tissues and less likely to permit passage of large molecules like those of colloid solutions. So replacement by isotonic crystalloids will lead to the development of non-burn edema which can be avoided by the use of colloids.

During fluid resuscitation of a patients with extensive burn, a balance should be made between the need of fast delivery of the small molecular sized crystalloids and the need of the large molecular sized colloid solutions which are associated with less generalized edema and hence a reduced amount of fluid required and a reduced period of plasma volume deficit.

Common Formulas for Fluid Replacement in burn patients

### **Evan's formula**

1st day requirement : 3 mls/kg Body weight/% BSA of equal portions of crystalloids and colloids

**Parkland's formula & Modified Brooke's** formula don't use colloids in the first day and use a higher rate of infusion. 1st day requirement : 4 mls/kg body weight/% BSA of Ringer's lactate. Half of this amount is given over the first 8 hours and half over the following 16 hours

### ***Monitoring of resuscitative adequacy***

- 1-Regular check-up of vital signs
- 2-The urine output should be 0.5-1 ml/kg body weight/hour
- 3- Monitoring of Central Venous Pressure (CVP)

### **2- Guarding against sepsis**

Isolation of the patient , proper local wound control and prophylactic antibiotics versus streptococcus pyogenes & staphylococcus aureus

### **3- Local Wound Care:**

#### **Conservative wound Management**

1. Exposure treatment
2. Occlusive treatment (Wound dressings)
3. Biological dressing & Skin banking
4. Prevention of scar hypertrophy & skin contractures

#### **Early Excision & Grafting**

### **Conservative Wound Management**

After cleaning the burn wound, topical antimicrobial cream should be applied, the ideal cream should be in a soluble base, prevents dryness, non-allergenic, non-toxic, & non injurious to viable cells

The most widely used creams world wide are: 1% silver sulphadiazine, 0.5% silver nitrate soaks and mafenide acetate

After application of cream either an exposure policy is adopted or the wound is covered by dressings

### ***Exposure treatment:***

The burned part is cleaned and left exposed to air, the exudates dries and, together with destroyed dermis and protein exudates forms a scab or eschar. This scab protects the underlying tissues from contamination.

### **Applications:**

1-Facial, cervical, & perineal burns

2-Small partial thickness burns involving only one surface of the body

### **Contraindications:**

1-Circumferential burns involving more than one body surface

2-Large full thickness burns

### **Advantages:**

1-More comfortable

2-More economic

3-Inhibits bacterial growth by dryness

### ***Occlusive treatment:***

The purpose of this method is to absorb exudates, and as far as possible protect against bacterial colonization of the wound.

### The ideal dressing:

1-Non adherent

2-Absorbent

3-Acting as a barrier against bacterial invasion

### **Tulle gras & Cotton wool pads**

The most popular and widely used dressing is the use of non-adherent tulle gras dressing covered by absorbent cotton wool pads which fulfill those criteria.

### **Modern Dressings**

1-Film dressings (OPSITE): A vapour permeable polyurethane film that forms a thin pliable bacteria proof coverage with enhanced rate of re-epithelialization.

2-Hydrocolloids (DUODERM): An impermeable outer cover which is bacterial proof.

### ***Biological Dressings & Skin Banking***

Following the previous regimens of wound care , all partial thickness burns should heal within 2-3 weeks while full thickness burns will need an autogenous skin graft. In cases where autografts are not enough or local wound conditions are not favorable we can resort to the use of biological dressings which when applied temporarily would render the wound less painful, minimize fluid & protein loss and control infection.

They are applied after removal of eschars and changed every 3-4 days. They are only temporary and final closure is only by autografts

Biological dressings include:

- 1-Isografts (from genetically identical human e.g. identical twin)
  - 2-Allografts (from genetically dissimilar human)
- Donor's skin (Skin Banking)  
Cadaver skin
- 2-Xenografts (from another species) (Pig's skin)
  - 3-Amniotic membrane
  - 4-More recently artificial skin substitutes

## Early Excision & Grafting

### Indications:

- 1-Deep dermal burns
- 2-Full thickness burns

### Contraindications:

- 1- Evidence of infection
- 2- Inhalation injury

### Technique:

There are two popular techniques for

- 1- Tangential excision using the skin grafting knife where excision done in layers till a healthy vascular layer is reached and is suitable for deep dermal burns.
- 2-Excision En Bloc used for full thickness burns

### Mesh grafts

Meshing of grafts using electric meshers has made a considerable contribution to the principle of early excision and grafting. A mesh graft allows for coverage of larger areas and reduces the number of grafting sessions needed to cover large areas. It also enhances wound drainage and promotes coalescence of the grafts.

## 4- Prevention & management of systemic complications

- 1- Inhalation injury: Asphyxia, bronchospasm, atelectasis , pneumonia & finally respiratory failure. Proper oxygenation should be started immediately and endotracheal intubation or tracheostomy and positive lung ventilation should be employed when needed
- 2-Neurogenic shock from pain is relieved by strong analgesia
- 3-Management of hypovolaemia
- 4-Acute renal failure can occur after prolonged uncorrected hypovolaemia and should be managed promptly with volume restoration, diuresis and dialysis if needed
- 5-Gastrointestinal complications:
  - Acute gastroduodenal ulceration should be prevented by the prophylactic use of H2 receptors blockers during the initial treatment
  - Ileus usually occurs during the early post burn period and necessitates the use of nasogastric suction
  - Acute non-calicular cholecystitis
  - Acute pancreatitis
  - Hepatic dysfunction
  - Multiple organ failure and generalized sepsis due to break of intestinal barrier and translocation of enteric bacteria into the circulation. The maintenance of mucosal integrity is facilitated by enteral feeding and avoiding splanchnic hypoperfusion

6- Toxic shock syndrome has been reported due to a particular strain of staphylococcus aureus especially in children and suggest the use of a prophylactic short course of erythromycin or cloxacillin in those patients

## **Management of disfigurement & disablement**

### **Hypertrophic scars & Contractures**

#### **Predisposing factors**

- 1-Old age
- 2-Dark races
- 3-Sites of skin tension e.g. over the sternum & shoulders
- 4-Healing by secondary intention: Infection, trauma or sepsis

#### **Prophylaxis:**

*1-Proper diagnosis of burn depth and early grafting of deep burns*

*2-Pressure Garments:*

The application of external constant pressure by pressure garments keeps the scars flat and pliable. In order for the pressure regimen to work:

- A-It should be applied as soon as healing occurs
- B-Worn for 12 months
- C-Worn 24 hours per day, only removed for creaming or bathing
- D-Washed daily to maintain elasticity
- E-Fitted accurately and regularly reviewed

*3-Creaming and massage*

Newly healed or grafted skin is thin and has no oil glands. Creaming and massage play a vital role in maintaining the lubrication and elasticity of skin and therefore assisting in maintaining the range of movement. Skin should be washed and creamed three times per day and may be increased if skin looks dry or tight. Massage should be done by firm circular movements

*4-Protection from sun light*

In the first year after burn injury healed skin is more prone to sunburn and hyper pigmentation and prolonged exposure to sun light should be avoided and the use of a strong sun blocking cream should be followed

*5- Silicone Gel*

It can be used in the prevention & treatment of hypertrophic scarring, causing the scar to soften and flatten without the use of pressure. It is likely to involve both the hydration of the stratum corneum, and the release of a low molecular weight silicone fluid.

#### **Uses:**

- Anatomical depressions not fitted by pressure garments e.g. clavicle
- With pressure garments
- Lining of splints
- On its own , taped gently over the burnt area
- Across joints

*6-Management of itching:*

- Avoid scratching -Keep skin well moisturized
- Good personal hygiene -Massage
- Avoid over heating -Wear cotton clothes

- Pressure garments -Antihistaminics
- Silastic gel -Local anesthetic creams (EMLA)

*7-Splintage (Static or dynamic) in position of function in cases of burns around joints*  
*8- Camouflage cosmetics*

## **Treatment of hypertrophic scars**

### **Surgical Excision:**

- Primary closure which may be aided by skin expansion
- Skin grafting.
- Skin flaps which may be aided by skin expansion

### **Non surgical correction:**

- Radiation alone or before and after surgical excision to reduce the activity of fibroblasts in the wound
- Intradermal steroid injections into the scar
- Silicone gel application
- Pressure treatment

### **Contractures:**

Surgical release followed by:

Use of Flaps which may be aided by the use of tissue expanders

### **Indications of flap usage:**

- Unsuitable bed for grafting
- Inappropriate place for grafting e.g. across joints
- Need for bulky structural support
- Need for transfer of vascularized structures e.g. bones or innervated muscles

## **Types of flaps:**

### **Classification of flaps according to its blood supply**

Random flaps (Cutaneous)

Axial (Arterial) flaps

### **Classification of flaps according to its mobilization**

Local flaps: \* Moving around a fixed point (Rotation, Transposition & Interpolated flaps)

\* Advancement flaps (Single pedicled, bipedicled and V-Y flaps)

Distant flaps: Transferred to defect from distant position

Free flaps

### **Classification of flaps according to its structure**

Cutaneous flaps

Fasciocutaneous flaps

Myocutaneous flaps

Osseomyocutaneous flaps