BURNS

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ETIOLOGY (TYPES OF BURN):

1.THERMAL BURNS:

- ***Heat causes coagulative necrosis of tissue by coagulation of the cellular proteins.***
- ***Characterized by preservation of the shape of the tissue.***
- ***The depth (degree of burn) depends on the quantity of heat (temperature and duration of exposure), so exposure to a relatively lower temperature for long period may cause more damage than exposure to high temperature for a short period.***

Thermal burns is classified into:

A. Dry heat (direct flame burn) direct exposure to fire.
B. Moist heat (scald burn), exposure to hot liquids,
C.Contact burn. contact with hot metals.
D.Friction burns.

2.CHEMICAL BURNS:

- Caused by acids or alkalis.
- Deeper penetration and damage to the tissues.
- Acids produce less damage, and less penetration, than alkalis, because acids usually produce coagulative necrosis (denaturation of cellular proteins) this forms a barrier limiting the destructive effect of acids on tissues, while alkalis produce liquefaction necrosis, allowing deeper penetration and destruction.

- **The primary management of chemical burns is by irrigation of the area affected by water to dilute the chemical agent, this should continue for 2-4 hours in case of alkaline burn, and 30 minutes for burns caused by acids .**

3.ELECTRICAL BURNS:

- The severity of burn depends on the voltage.
- Tissue damage is inversely related to the **tissue resistance.**
- Nerves, muscles, blood, and blood vessels have low resistance, so they are affected most, while skin, and tendons, have high resistance, hence, they are less burned.
- Although nervous tissue is the most sensitive to electric injury, the major effect of electric burn involves the muscles due to their bulk.
- **So we can say that electric burn is muscle burn!!.**
- **It is very important to remember this fact, because a massively electrically burned patient may deceive the casualty officer who finds minimal skin burn while the patient suffers massive hidden muscle burn. ELECTRIC BURN IS DECEIVING!!!**

Effect of electrical burns on tissues.

❖ *Nervous tissue*

CNS: Brain injury

PNS: peripheral nerve injury

❖*Muscular tissue*

CARDIAC: Arrhythmias

SKELETAL: -Myoglobinemia, myoglobinuria, AKI

-Compartment syndrome.

-Bone fractures

❖*Skin*

-Deceiving

-Cannot apply Parkland's formula

Management of electrical burns.

1. Cardiac arrythmias
2. Central nervous system: loss of consciousness
3. Skeletal muscle damage leads to:

A. Myoglubin is released from the damaged muscles leading to myoglobinemia and myoglobinuria that caused acute renal failure. good hydration, and alkalization of urine are measures to be used to prevent this renal impairment.

B. compartment syndrome, so limb vascularity should be observed, and fascitomy considered.

C. severe muscle contraction may cause bone fractures.

4. The severity of the electrical burn is not evident, and can not be estimated, as in the case of thermal burn, which depends on the percentage of the burned skin, so fluid management could not be based on a calculated Parkland's formula as in thermal injury, but on close clinical observation, urine output, serial hematocrit values, and CVP readings.


2000
1500

ASSESSMENT OF THE SEVERITY OF BURN.

1. **The depth of burn damage (degree): determines the local management and outcome of the burn wound.**

2. **The percentage of surface area involved in burn: This determines the prognosis (mortality rate) and the systemic management and complications: fluid resuscitation and the systemic complications as sepsis, catabolism and decreased immunity.**

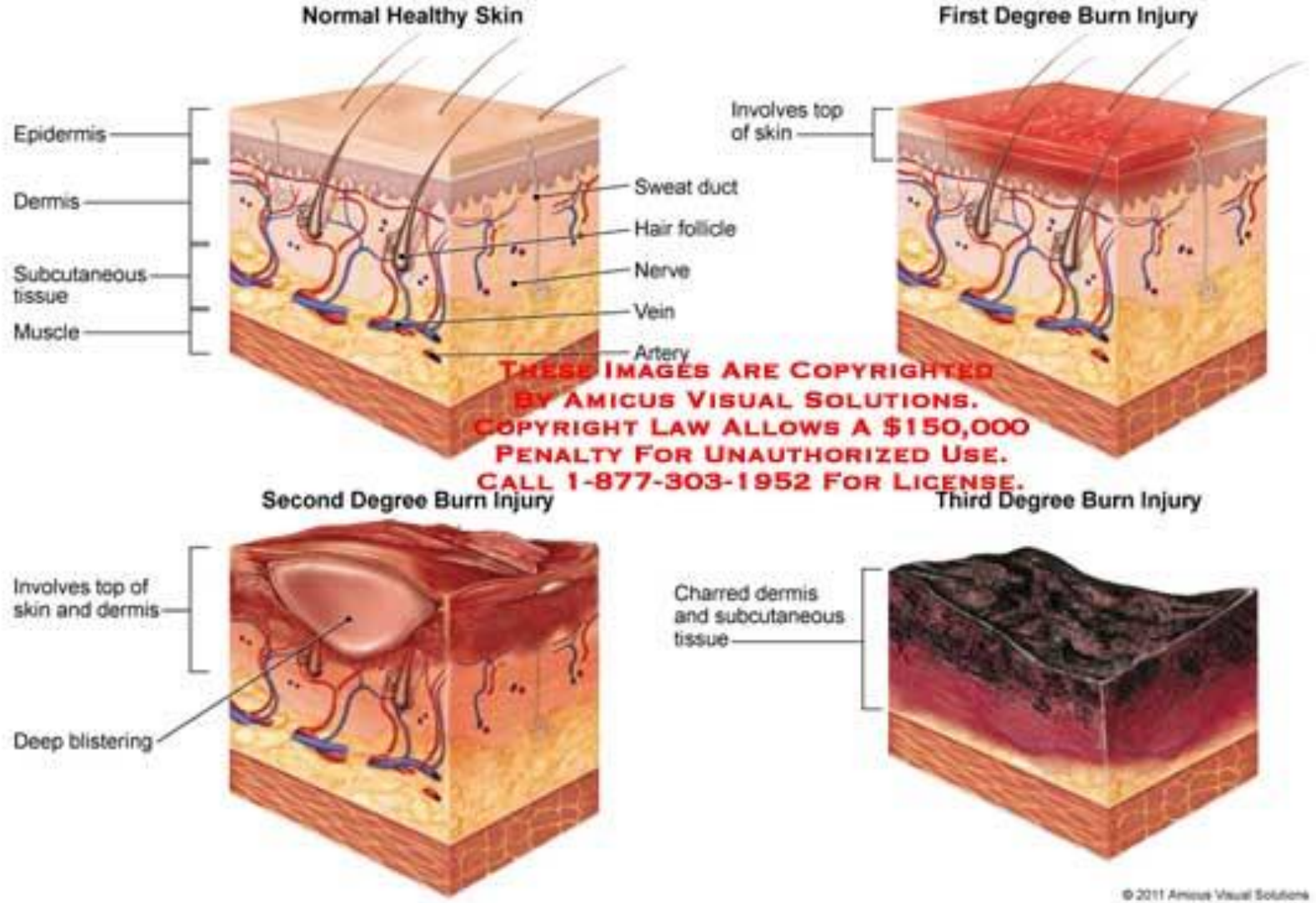
DEGREE OF BURN

❖ In partial thickness burn, part of the dermis containing skin appendages is preserved, from these epithelial elements, the burn wound would heal by **REGENERATION** within weeks, hence the local treatment of the burn is **conservative (no skin grafts)**.

❖While in full thickness burn all the dermis with the epithelial elements are lost, so the burn wound would naturally heal by **FIBROSIS** with all its **functional**, and **cosmetic** complications, to avoid this unfavorable fate, full thickness burns, should be treated by **skin grafting**.

❖ According to the previous discussion, the deeper the burn is, the more the scarring would be, and the more time is taken to heal.

Varying Degrees of Burn Injuries



Classification of the depth of burn injury(degree):

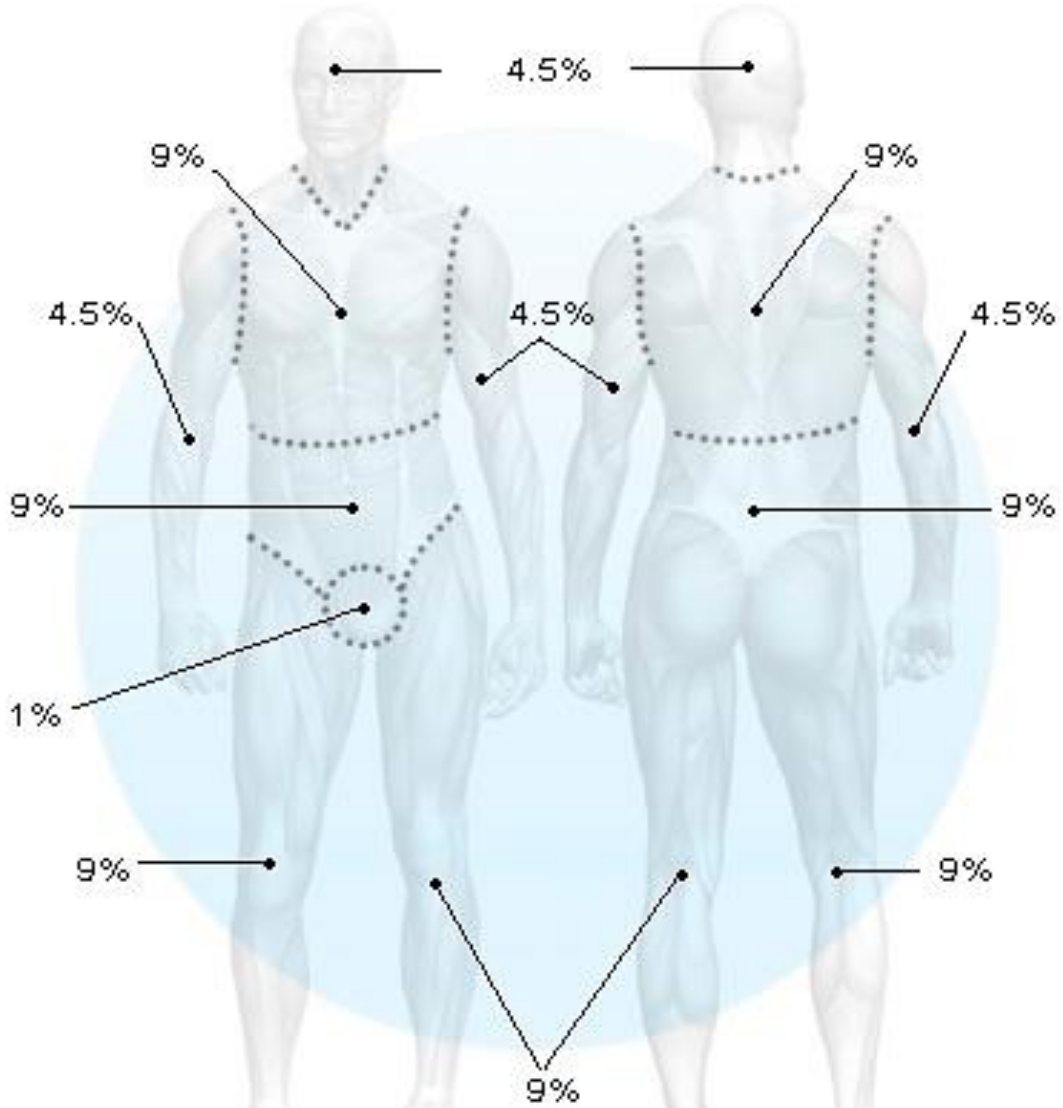
1.**First degree burn**, thermal necrosis is limited to the epidermis, clinically there is pain, and erythema, **it takes 1-6 days** to heal and leaves no scars.
2.**Second degree burn (partial thickness),** necrosis of the epidermis and varying depth of the dermis, characterized clinically by **pain** (due to irritation of the dermal sensory nerves), **erythema**, **blisters(bullae)**, the burned area is **wet with exudate** (weeping), **blanching** denoting intact dermal vascularity, and **preservation of skin elasticity. It takes 1-4 weeks to heal and leaves variable degrees of scarring.**
3. **Third degree burn (full thickness),** necrosis of the whole skin (epidermis and dermis) and its skin appendages, clinically there is an ***eschar*** which is simply -the burned necrotic skin -, it is **insensitive**, **leathery**, hard, **inelastic**, **and may show thrombosed dermal vessels. It takes months to heal and leaves significant scarring, to avoid scarring it should be skin grafted.**

Note that the deeper the burn the more dermis is necrotic so:

- **Less pain due to damage of dermal nerves.**
- **Healing is by fibrosis rather than regeneration. So leaving more post burn contractures**
- **More loss of skin elasticity, so it compresses the limbs that needs escharotomy.**

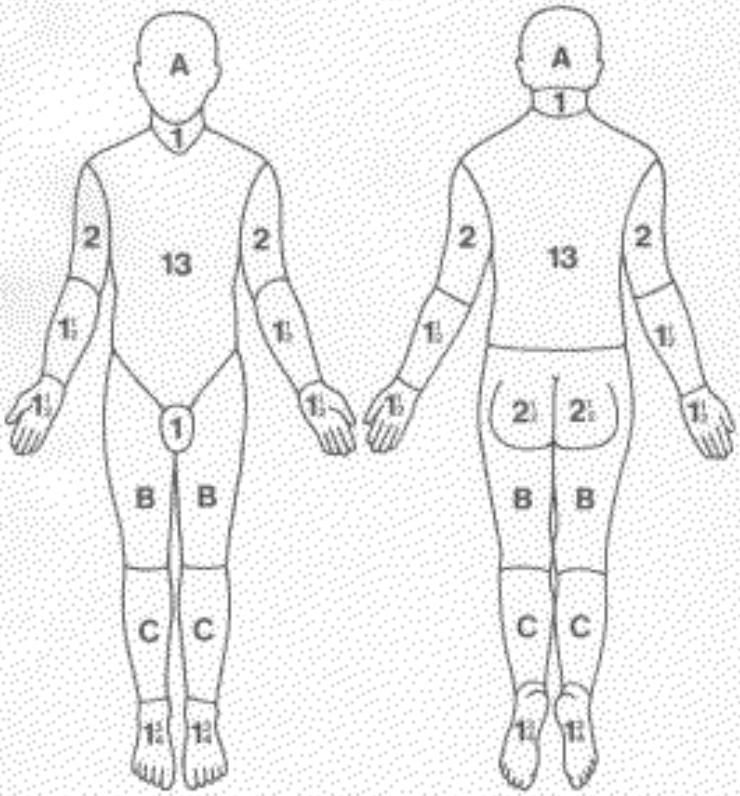
***ESTIMATION OF THE PERCENTAGE OF BURN*:**

Burn Percentage in Adults: # Rule of Nines



LUND AND BROWDER CHARTS

IGNORE
SIMPLE ERYTHEMA

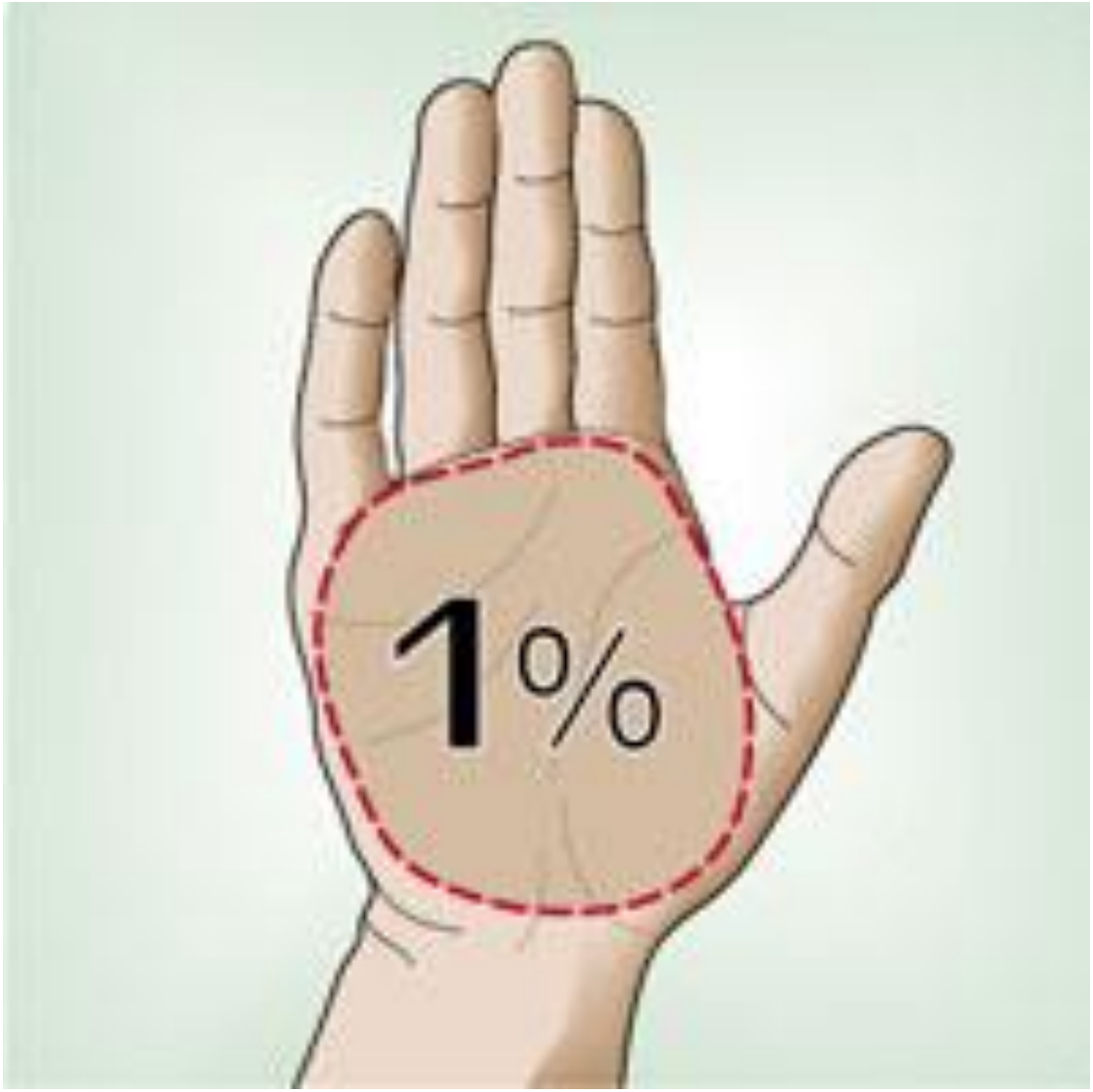


Superficial
Deep

REGION	%
HEAD	
NECK	
ANT. TRUNK	
POST. TRUNK	
RIGHT ARM	
LEFT ARM	
BUTTOCKS	
GENITALIA	
RIGHT LEG	
LEFT LEG	
TOTAL BURN	

RELATIVE PERCENTAGE OF BODY SURFACE AREA
AFFECTED BY GROWTH

AREA	AGE 0	1	5	10	15	ADULT
A = ½ OF HEAD	9½	8½	6½	5½	4½	3½
B = ½ OF ONE THIGH	2¾	3¼	4	4½	4½	4¾
C = ½ OF ONE LEG	2½	2½	2¾	3	3¼	3½


1%

***Management of burn is divided into*:**

1. Acute or emergency stage.
2. Local management of burn wounds.
3. Treatment of complications.

ACUTE OR EMERGENCY MANAGEMENT

Follow the ATLS (**A**dvanced **T**rauma **L**ife **S**upport) A, B, C,D,E rules.

AIRWAY: upper airway obstruction, due to soft tissue edema of the oropharynx and vocal cords, resulting from direct thermal injury to the upper respiratory tract in the first 24 hours.

Signs of impending obstruction include:
Tachycardia, progressive hoarseness, and difficulty to clear bronchial secretions.

CARBON MONOXIDE POISONING: This is due to occupation of the oxygen carrying sites of hemoglobin by CO, which has 210 times higher affinity to hemoglobin than oxygen. The condition is diagnosed by estimation of carboxyhemoglobin level in the blood, the PO2 level may be normal, as this is an estimation of the oxygen dissolved in the plasma. The treatment is by administration of 100% oxygen in order to displace the tightly bound CO from hemoglobin.

FLUID MANAGEMENT OF BURNED PATIENT.

•***Burn hypovolemic shock*:**

- **Caused by shift of fluids from the INTRA-VASCULAR to INTERSTITIAL compartment.**

- Due to **increase capillary permeability**, or loss of the capillary integrity.
- The shifted fluid is called **THIRD SPACE LOSS**, causes edema in the intestitium.
- Severity depends on the percentage of burn.

- **burn shock is seen in adults with burns greater than 15-20% and in children with burn more than 10-15% .**

Amount of fluid given should be just adequate to perfuse tissue.

Over-perfusion causes harmful edema that causes tissue ischemia

Parkland's formula:

- **Fluid in the first 24 hours = 4 X Weight X % of burn**
- **Half of the calculated fluid is administered in the first 8 hours, and the remaining half over the next 16 hours.**
- **Ringer's lactate.**

Type of fluids to be given:

Because the capillaries are leaky initially, it is wise to give crystalloids (Ringer's lactate) , in the first 24 hours, and to give colloids thereafter.

- **Urine output is the most sensitive indicator of tissue perfusion.**

- **In adults it should be 0.5-1 ml / kg / hour, In children it should be 1-2 ml / kg / hour.**

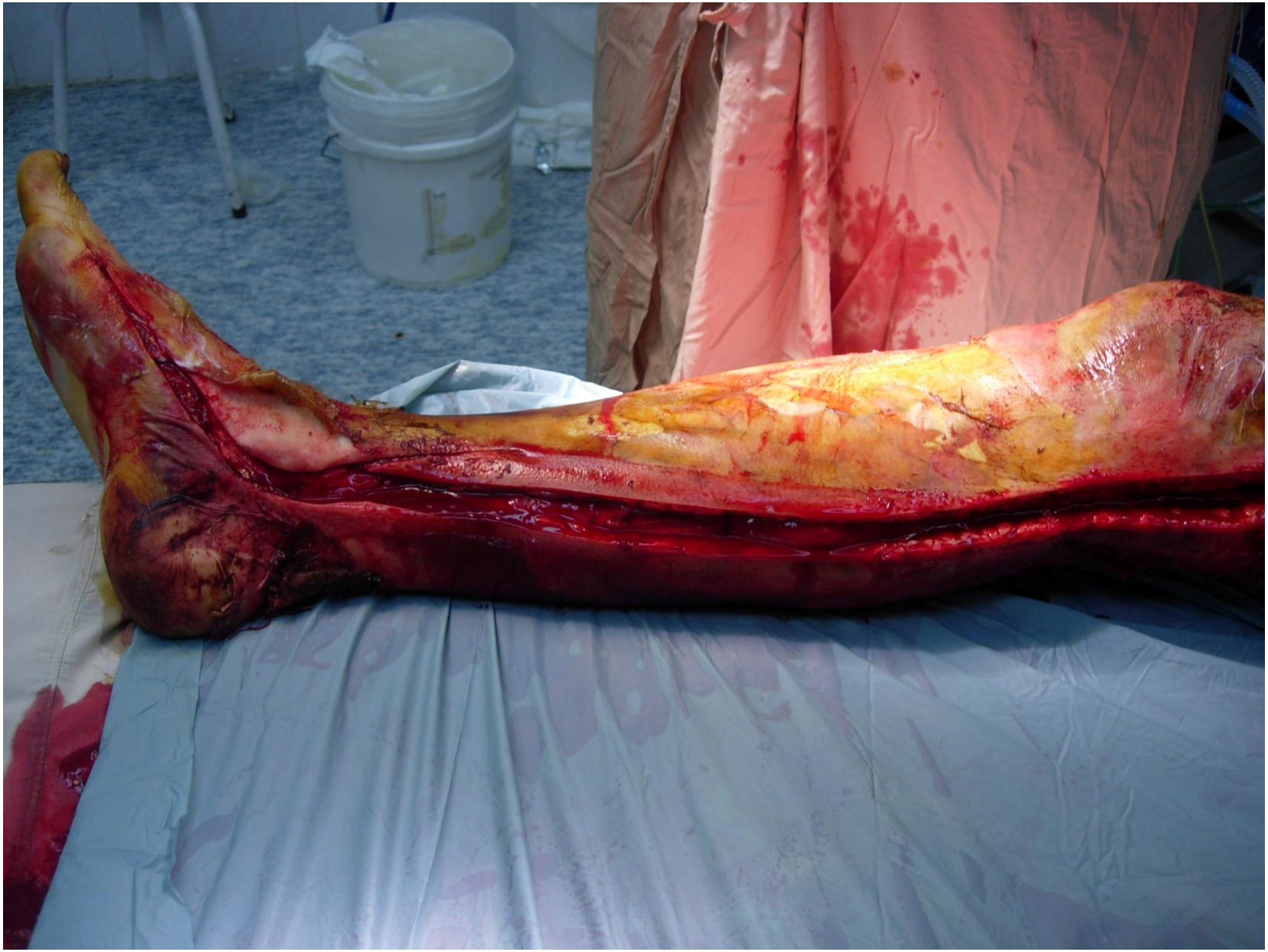
- **Higher urine output may indicate over-resuscitation that leads to harmful tissue edema.**

ESCHAROTOMY

In full thickness burns(3rd degree burn): the skin which is normally elastic, is transformed into eschar (dead or necrotic skin) , with loss of elasticity, so in circumferential full-thickness burns of the limbs , the eschar would act as a tourniquet. when the burned tissues develops edema ,the pressure inside the limb increases above the capillary pressure level (32 mm/ Hg) leading to tissue ischemia. The picture is similar to compartment syndrome.

ESCHAROTOMY IS DONE ON:

-LIMBS
-CHEST
-NECK



Chest Escharotomy

ANTIBIOTICS

Are used to treat infections, but not prophylactically

Prophylactic antibiotics are contra-indicated in burns, for the following reasons:

- Studies did not prove that prophylactic antibiotics decrease the incidence of sepsis.
- Antibiotics increase the incidence of fungal infections.
- Antibiotics increase the incidence of bacterial resistance.

ANALGESIA AND SEDATION:

A sort of pain and anxiety relieve, is needed in the burn victim, even in those with full thickness burn, the following guidelines are to be applied:

1.In patients with low tissue perfusion, the drugs should be administered by the intra-venous route to avoid accumulation of the drug.

2. Given in increments of small doses, till the required dose is reached.

3.Head injury, hypoxia, and shock all have the same symptomatology of pain, so these should be ruled out before treating pain.

INDICATIONS OF ADDMISSION TO HOSPITAL

- Burns that need fluid resuscitation: Adults>15%, children>10%).
- Full-thickness burns> 2%
- Burns of special areas: face, hands, perineum.
- Elecrtic and chemical burns.
- Inhalation injury.
- Old age and co-morbidity.
- Suspected child abuse.

LOCAL MANAGEMENT OF BURN WOUND.

PARTIAL THICKNESS BURN

IS TREATED CONSERVATIVELY

FULL THICKNESS BURNS ARE USUALLY TREATED BY SKIN GRAFTS

Advantages of early escharectomy and grafting:

- Decrease the duration of hospital stay.
- Decrease the incidence of burn wound sepsis, by elimination of the dead tissue and bacteria.
- Helps early mobilization of the patient, decreasing joint contractures.
- Shortens the catabolic state, minimizing the protein breakdown, and malnutrition.
- Better cosmetic outcome.

However, early burn wound excision is associated with the following problems:

The eschar is adherent to the underlying tissues, so surgical excision results in massive blood loss, and hypo-thermia.

When the burned area is large (i.e.>60 %burn), excision would leave a large exposed wound that we can not cover by the patients own skin.

The first problem is solved by, better blood banking, better ICU care, hypotensive anesthesia, and staged excision.

The second problem is dealt with by, temporary coverage of the excised areas, with biological dressings: These are either, allografts (homografts), taken from cadavers, or heterografts, taken from animals, they are applied as temporary dressing to the excised burn wounds.

So after eschar excision, we cover as much as we can of the excised areas with split thickness skin graft (autografts), the remaining areas are covered temporarily with biological dressing . After around two weeks, when the donor areas heal, we take skin grafts again from the same donor areas, (reharvesting) and apply them to new areas after taking off the biological dressing.