BURNS AND BURN MANAGEMENT

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PLASTIC SURGEON

Objectives

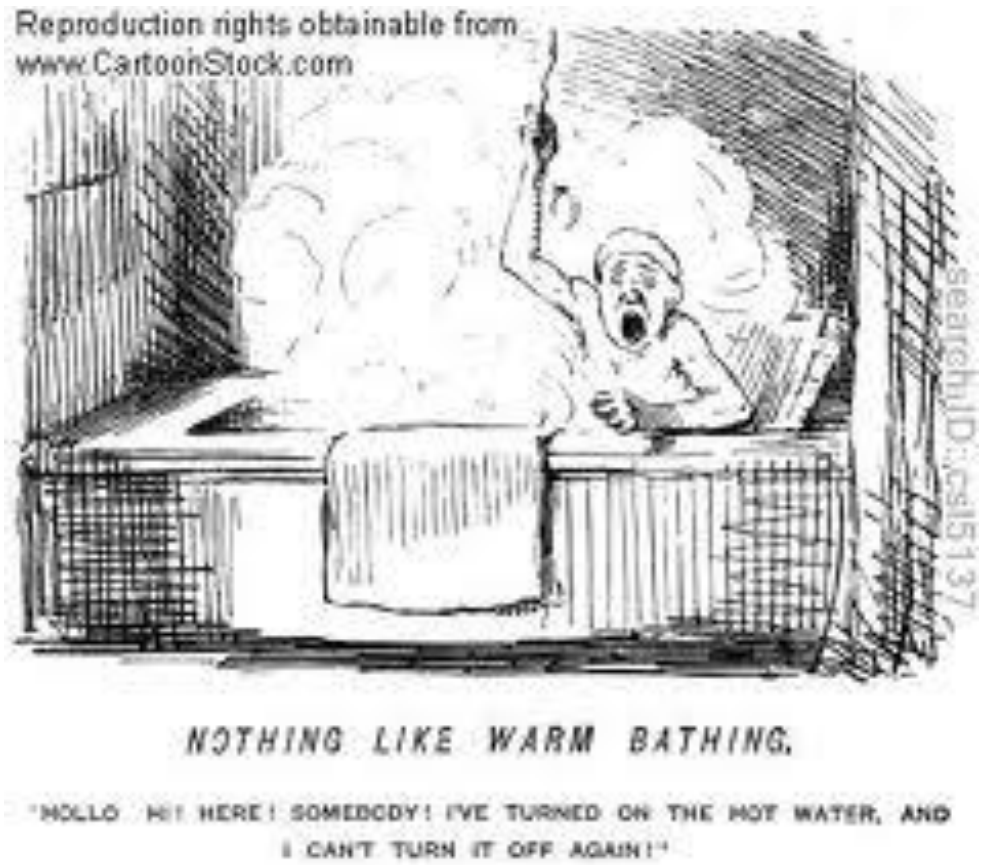
- To understand the structured approach to the burnt patient
- To recognize and treat the consequences of severe burns

RISK FACTORS

- Very young and very old have a high risk of death
- Burns in combination with an inhalation injury always worsen a patient's prognosis

- Initiates the inflammatory response
  - Heat
  - Redness
  - Pain
  - Localized and systemic edema formation
- Amount of edema correlates with the depth, extent of injury (TBSA burn), and fluids administered.

TYPES OF BURNS



SCALD

- Caused by hot water (most common burn in civilian practice)
- • 140F (60C) ---> deep partial of full thickness burns in 3 secs.
- • Exposed areas of skin burned less than clothed areas
- Children and elderly has thinner skin •
- Immersion has longer contact
- Scald burns from grease or hot oil are deep burns (400F/200C).

- Hot water

HEAT

- Caused by flame, flash, scald, or contact burns •
- STOP & DROP • Roll to shut off O2 supply to fire
- Flush or immerse in cold water
- DO NOT use ICE on deep burns, just localized, superficial burns

Thermal burns

2nd most common mechanism of thermal injury. (house fire).

THERMAL BURNS

Smoke inhalation can lead to the absorption of Carbon Monoxide. CO has a higher affinity to attach to red blood cells than oxygen. This leads to impaired delivery and/or utilization of oxygen. This eventually results in systemic tissue hypoxia and death.

Pulse oxygen monitor cannot differentiate between oxygen and CO. This further delays treatment of CO poisoning.

THERMAL BURNS

INHALATIONAL INJURY

- Soot contains elemental carbon and can absorb toxins from burning materials that are toxic to the bronchial mucosa and alveoli because of the pH and the ability to form free radicals.
- These compounds can cause airway inflammation and multiple complications.

Impaired Gas Exchange results in tissue hypoxia secondary to carbon monoxide poisoning •

CO poisoning is the MOST immediate cause of death from fire.

Signs of CO poisning

Edema of Airway •

Hoarseness

Dysphagia

Stridor

Copius Secretions usually black tinged •

Skin will appear cherry red

- Majority of house fire deaths •
- CO_2 is colorless, odorless and tasteless gas w/ ffinity to Hgb 200x that of 02

. • Mechanisms of interfering O2 delivery:

• Prevents reversible displacement of O2 on the Hgb molecule •

CO Hg shifts the O2-Hg dissociation curve to the left

. • CO_2 binds to reduced cytochrome a3, causing less effective intracellular respiration

• CO bind to cardiac and skeletal muscle, direct toxicity

• CO act in CNS causing demyelination causing neurologic symptoms.

SYMPTOMS:

- Headache,
- N/V,
- loss of manual dexterity •
- Weak, confused and lethargic •
- Coma •
- CO reversibly bound to the heme:
- • Room temp = half-life (t1/2) of COHb is 4hrs •
- 100% O2 = t1/2 is reduced to 45-60mins •
- Hyperbaric O2 at 2atm. = t1/2 30mins • Hyperbaric)2 at 3atm. = t1/2 15-20min •
- Tx: 100% oxygen via a nonbreather face mask

FLASH BURNS: EXPLOSION OF NATURAL GAS (PETROLEUM) TYPICALLY EPIDERMAL OR PARTIAL THICKNESS

Sudden exposure to hot air typically triggers reflex closure of the vocal cords

Flash burns cause the most damage to the upper airway.

Injuries tend to be limited to the supraglottic airways.

Heat produces edema and can lead to obstruction of the airway.

CONTACT

FRICTION

Contact Burns: • Hot metals, plastic, glass or hot coals • Industrial accidents, motor vehicle • Are often 4th degree burns.

TYPES OF BURN

- Chemical

Acids: Drain cleaners
Alkali: Rust removers, swimming pool cleaners
Organic compounds: Phenols and petroleum cleaners

Remove person from contact with agent •

Flush with water continuously (20 minutes)

- Remove affected clothing if possible(cutting not tearing)
- Alkaline agents worse than acid, process keeps going

CHEMICAL BURNS

- Denature protein within the the tissues or a desiccation of cells.
- Alkali products cause more tissue damage than acids.
- Dry substances should be wiped off first.
- Wet substances should be irrigated with copious amounts of water.
- All fluids used to flush should be collected and contained not placed into the general drainage system.
- Decontaminate patient: flush with warm water medially to laterally
- Protect yourself

ALKALI BURNS GO DEEP

http://www.burnsurgery.com/Betaweb/Modules/initial/bsinitialsec8.htm

TREATMENT OF HF BURNS

- Immerse burn area for 2 hours in 0.2% iced aqueous tetracaine benzethonium chloride (Hyamine 1622) or iced aqueous benzalkonium chloride (Zephiran).
- Apply towels soaked with Zephiran and change every 2-4 minutes.
- Ice packs to relieve pain
- Obtain serum chemistries: hypocalcemia, hyperkalemia
- Insitiute cardiac monitoring: HF acid exposure can:
  - prolong QT interval
  - peak T waves
  - ventricular dysrhythmias

TAR BURN

- Note the white area in the exposed wound, indicating the burn to be very deep.
- The temperature of the tar will make the difference on depth.
- cooling the tar in IMPERATIVE. Pain is minimal and injury can be easily underestimated.
- Best removal is Neosporin contains the emulsifier Tween-80 which is useful in dissolving the tar.

CHEMICALS BURNS

- Is the pain our of proportion to the skin involvement? Consider hydrofluoric burns
  - Hydrofluoric acid burns are unique in several ways
    - Hydrofluoric (HF) acid, one of the strongest inorganic acids, is used mainly for industrial purposes (eg, glass etching, metal cleaning, electronics manufacturing).
    - Hydrofluoric acid also may be found in home rust removers.
    - Dilute solutions deeply penetrate before dissociating, thus causing delayed injury and symptoms. Burns to the fingers and nail beds may leave the overlying nails intact, and pain may be severe with little surface abnormality.
    - The vast majority of cases involve only small areas of exposure, usually on the digits.
    - A unique feature of HF exposure is its ability to cause significant systemic toxicity due to fluoride poisoning.

CHEMICAL BURNS

The depth can be deceiving until the tissue begins to slough off days later.

Because of this chemical burns should always be considered deep partial-thickness or full-thickness burns.

HF TREATMENT

- Calcium gluconate:
  - Apply 2.5% calcium gluconate gel to burn area
  - Subcutaneous infiltration: 0.5mL of 10% calcium gluconate/cm2 of burn, extending 0.5 cm beyond margin of involved tissue.
  - IV regional: Dilute 10-15 mL of 10% calcium gluconate in 5000 units heparin, then dilute in 40 mL dextrose 5% in water (D5W)

ELECTRICAL BURNS

- Coagulation necrosis •
- Severity depends on voltage, amount of resistance, time, and current pathways.
- **Frequently only entry (yellow-white) and exit (blow out)** wounds are visible •

. • Extensive tissue damage is masked

Patient at risk for arrhythmias due to _____,

metabolic acidosis due to _____,

and acute tubular necrosis due to _____. •

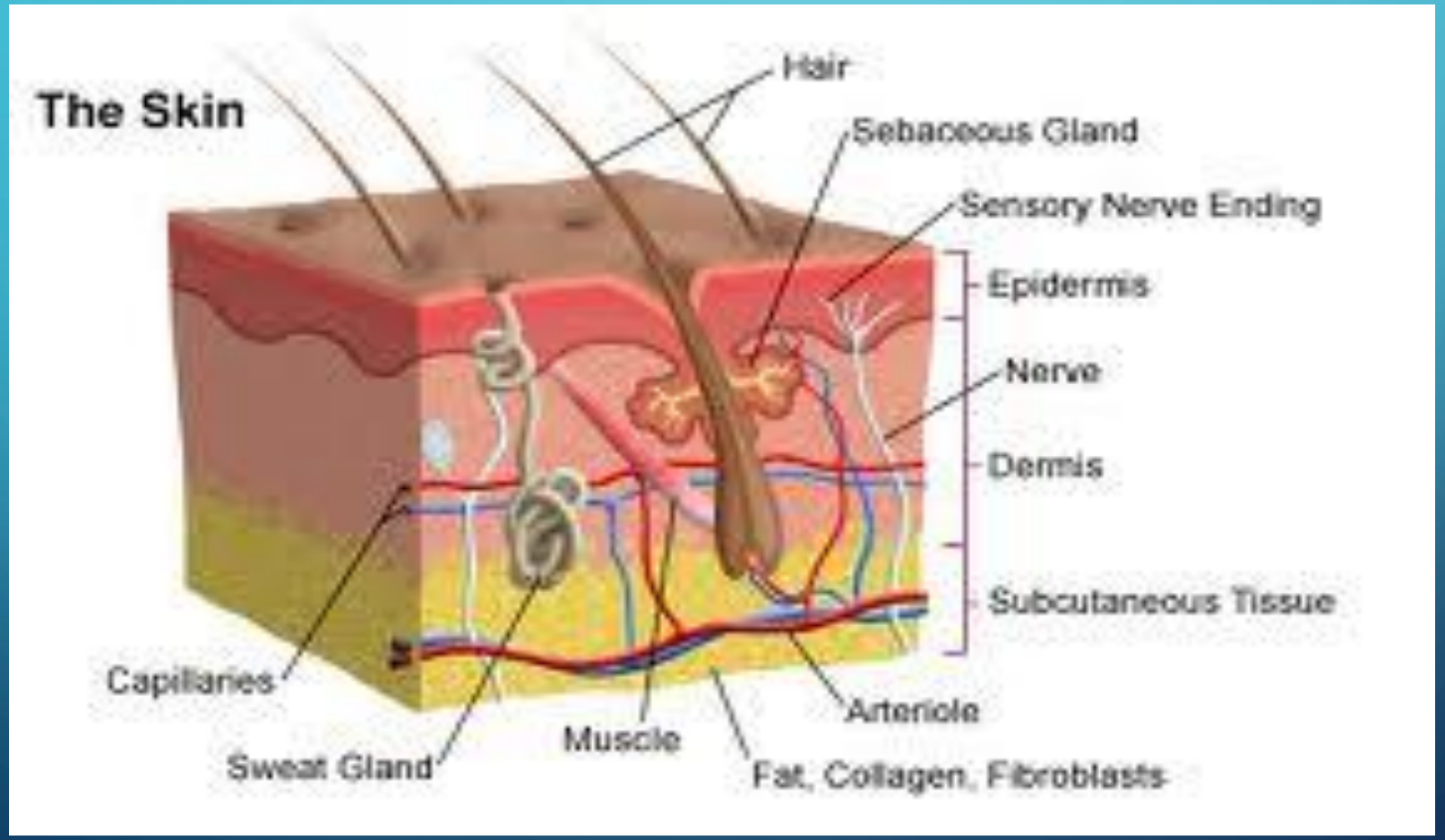
Current can be so strong to fracture long bones and cause respiratory muscles to contract

ELECTRICAL

- AC- Alternating current- household current (more likely to induce fibrillation)
- DC- Direct current- car battery

- Path of least resistance:
  - —electrical current will find the easiest way to travel through the body. Nerves tissue, muscle and blood vessels are easier to travel through than bone or fat.
  - —nervous system is particularly sensitive. damage seen in the brain, spinal cord and myelin-producing cells.

DEGREE OF BURNS
ASSESSMENT OF DEPTH



BURNS
ASSESSMENT OF DEPTH

- Superficial: pain, erythema, no blisters

- Sunburn , UV light, mild radiation, Pink to red Slight edema Mild pain

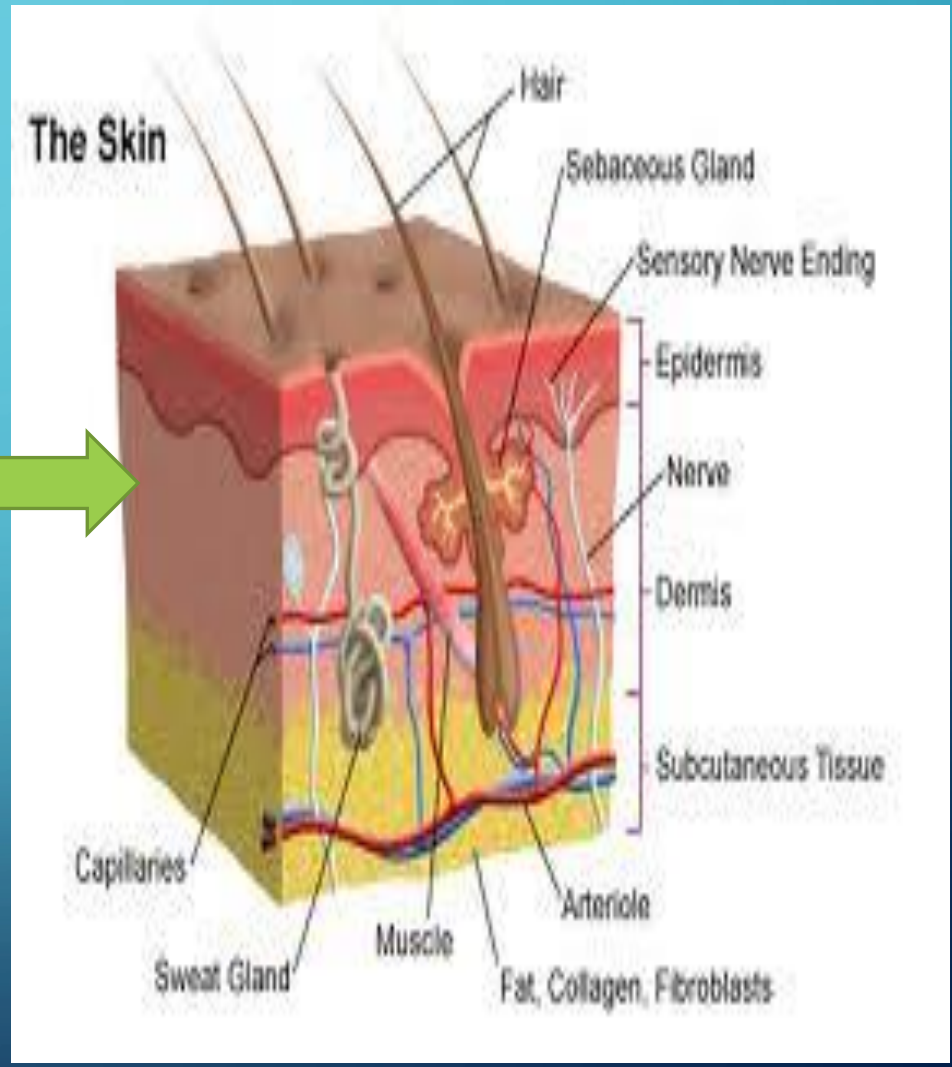

The Light!!
It Burns!!!

BURNS
ASSESSMENT OF DEPTH

- Superficial: pain, erythema, no blisters
- Partial thickness: painful, weeping, blisters, mottled

- Superficial Partial Thickness (2nd) • Epidermis and some of dermis, is painful, red, blisters

- Deep Partial Thickness (2nd) • Epidermis and Dermis • Very Painful, edema, pale • Moist or dry, but more commonly wet • Blisters

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BURNS
ASSESSMENT OF DEPTH

- Superficial: pain, erythema, no blisters
- Partial thickness: painful, weeping, blisters, mottled
- Full thickness: painless, white/dark and leathery
  - Epidermis, Dermis, and Subcutaneous tissue burned • Nerve endings destroyed • Little or no pain

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BURNS
ASSESSMENT OF DEPTH

- Superficial: pain, erythema, no blisters
- Partial thickness: painful, weeping, blisters, mottled
- Full thickness: painless, white/dark and leathery
- Depth less important than size in early resuscitation


مركز التأهيل الملكي
ROYAL REHABILITATION CENTER

BURNS
APPROACH

- Stop the burning
- ABCDE
- Determine area of burn
- Good IV access
- Early fluid replacement
- Prevent hypothermia

BURNS
MORTALITY

Early death

- airway obstruction
- respiratory failure
- shock

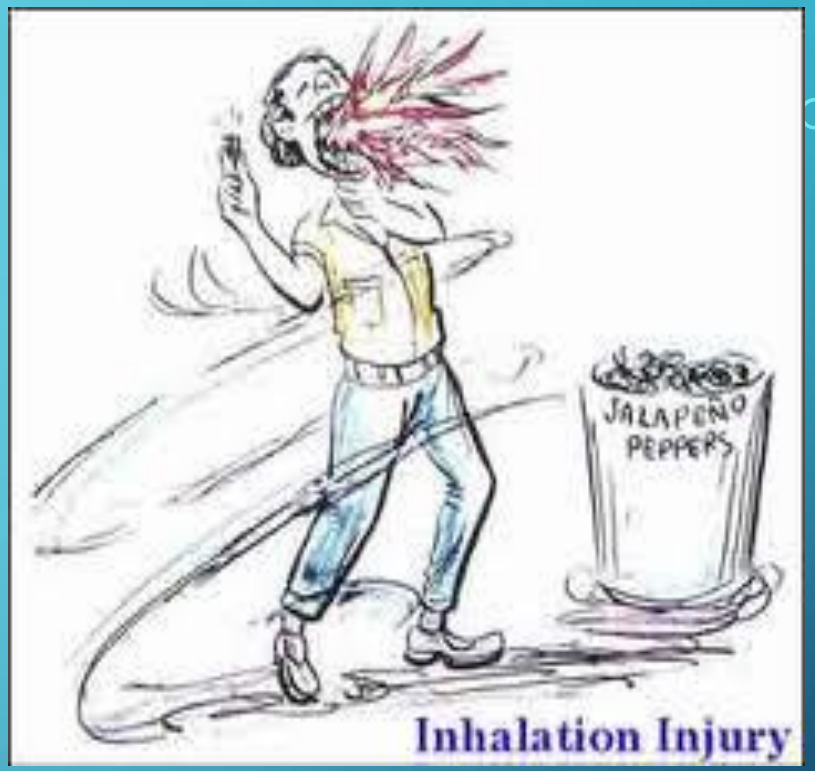
Late death

- renal failure
- sepsis
- multiple organ failure

C-SPINE

- Any trauma (fall or RTI)- concerning c-spine injury?
- IMMOBILIZE EARLY
- Remember ACLS! Jaw thrust/chin lift or Head tilt appropriate?

BURNS
AIRWAY



Consider early intubation

- ↑ Hoarseness
- Difficulty swallowing secretions
- ↑ Respiratory distress
- Transfer required

BURNS BREATHING

Suspect inhalational injury

- Fire in enclosed space
- Burns around mouth, face, nasal hair
- Respiratory distress
- Hoarseness, cough, stridor
- Ash in sputum
- Swelling in the airway

BREATHING

- Chest rise and fall
- Retractions, Rate
- Circumferential cyanosis
- Breath sounds

BURNS
CIRCULATION

- Treat shock
- Calculate ongoing fluids on size of burn
- Oral rehydration possible in smaller burns
- Maintain urinary output 0.5-1.0 ml/kg/hr

CIRCULATION

- Shock and tissue perfusion
- Color of skin
- Blistering
- Depth of burn (degree)
- Capillary refill

THIS COMBO IS BAD

I. Fluid shift

II. Edema formation

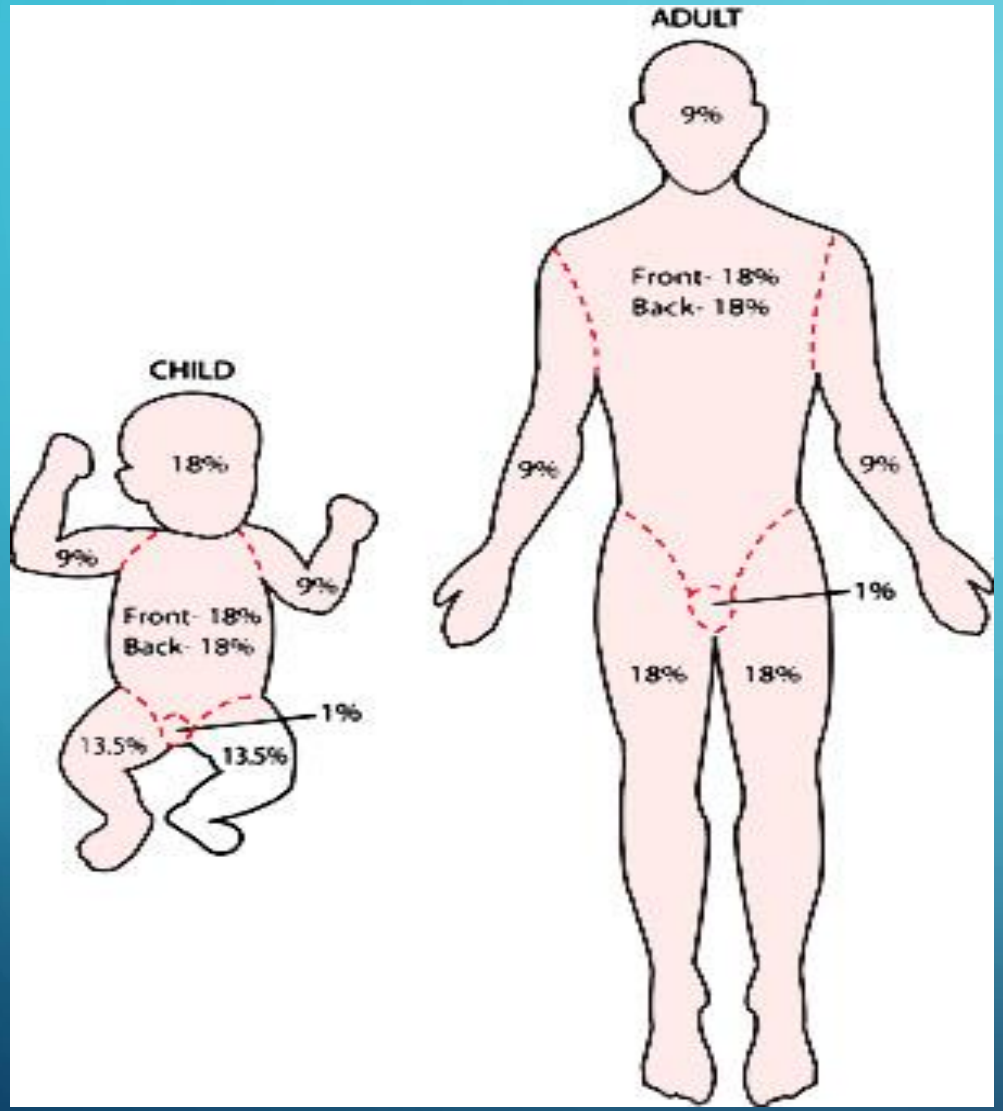
III. Evaporative water loss from the burn

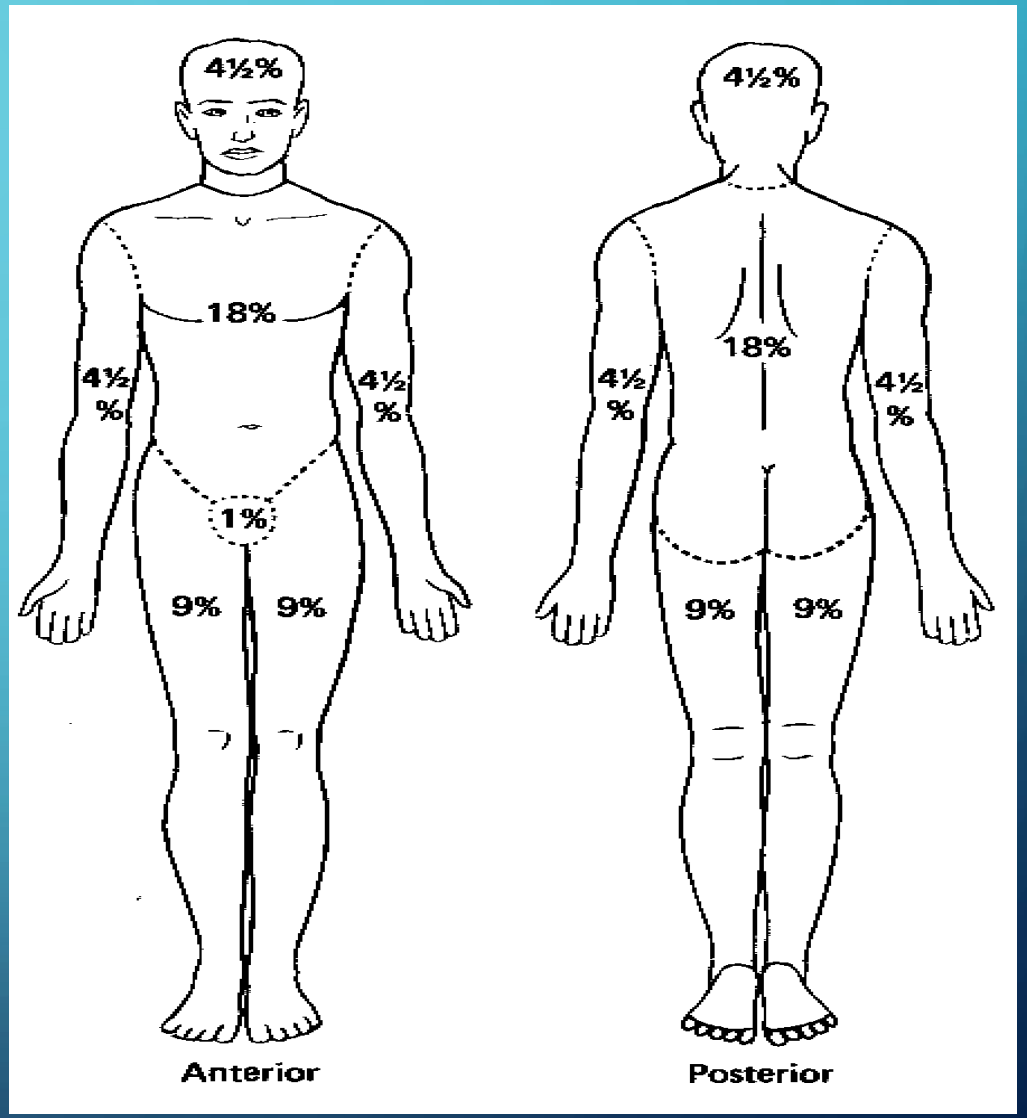
= VI. Hypovolemia (burn shock)

LOSS OF PLASMA IS GREATEST IN THE FIRST 4-6 HOURS AFTER THE BURN INJURY

BURN AREA ASSESSMENT

Head and neck		9%
Upper limb		9%
Front of trunk	18%	
Back of trunk	18%	
Lower limb		9%
Perineum		1%


ADULT
9%
Front- 18%
Back- 18%
9%
9%
1%
18%
18%
CHILD
18%
9%
9%
Front- 18%
Back- 18%
1%
13.5%
13.5%


4½%
18%
4½ %
4½ %
1%
9%
9%
Anterior
4½%
18%
4½ %
4½ %
9%
9%
Posterior

BURNS
CIRCULATION - FLUID RESUSCITATION

- 2-4 ml crystalloid/kg/% burn in first 24 hours
  - 1/2 of fluid in first 8 hours
  - 1/2 of fluid over next 16 hours
- Remember maintenance fluids
- Calculations are only a guide

- Remember that a formula is only an estimate and adjustments need to be made based on patient's status.
- **Fluid Resuscitation Protocol**
- Establish and maintain adequate circulation

↓

- Burns >20% TBS require initial fluid resuscitation

↓

- Use at least one large bore intravenous catheter. Begin Ringer's Lactate. Estimate initial rate according to the estimated percent of total body skin surface burned (%TBS). Estimated body weight (4cc/kg/%TBS burn in 24 hours giving half of the estimate in 1-8 hours.)

↓

- Maintain: Blood Pressure>90 systolic, Urine output 0.5-1.0ml/kg/hr, Pulse <130Temperature >37° C

↓

- Modify protocol in the presence of massive burns, inhalation injury, shock, and in elderly patients:- Fluid requirements are greater to prevent burn shock- Include colloid: either Hespan or Albumin in the patients from the beginning

↓

- **Transfer to Burn Center if a Major Burn is Present or a Moderate Burn depending on Local Resources**

BURNS
EXPOSURE

Cover patient to prevent hypothermia

Hypothermia may render an injured child refractory to treatment.

BURNS
OTHER ISSUES

- Analgesia
- Nasogastric drainage/ulcer
- Tetanus prophylaxis
- Beware of other injuries


WATERPROOF WORKS

BURNS
OTHER ISSUES

- Analgesia
- Nasogastric drainage
- Tetanus prophylaxis
- Beware of other injuries
- Beware electrical burns

BURNS
OTHER ISSUES

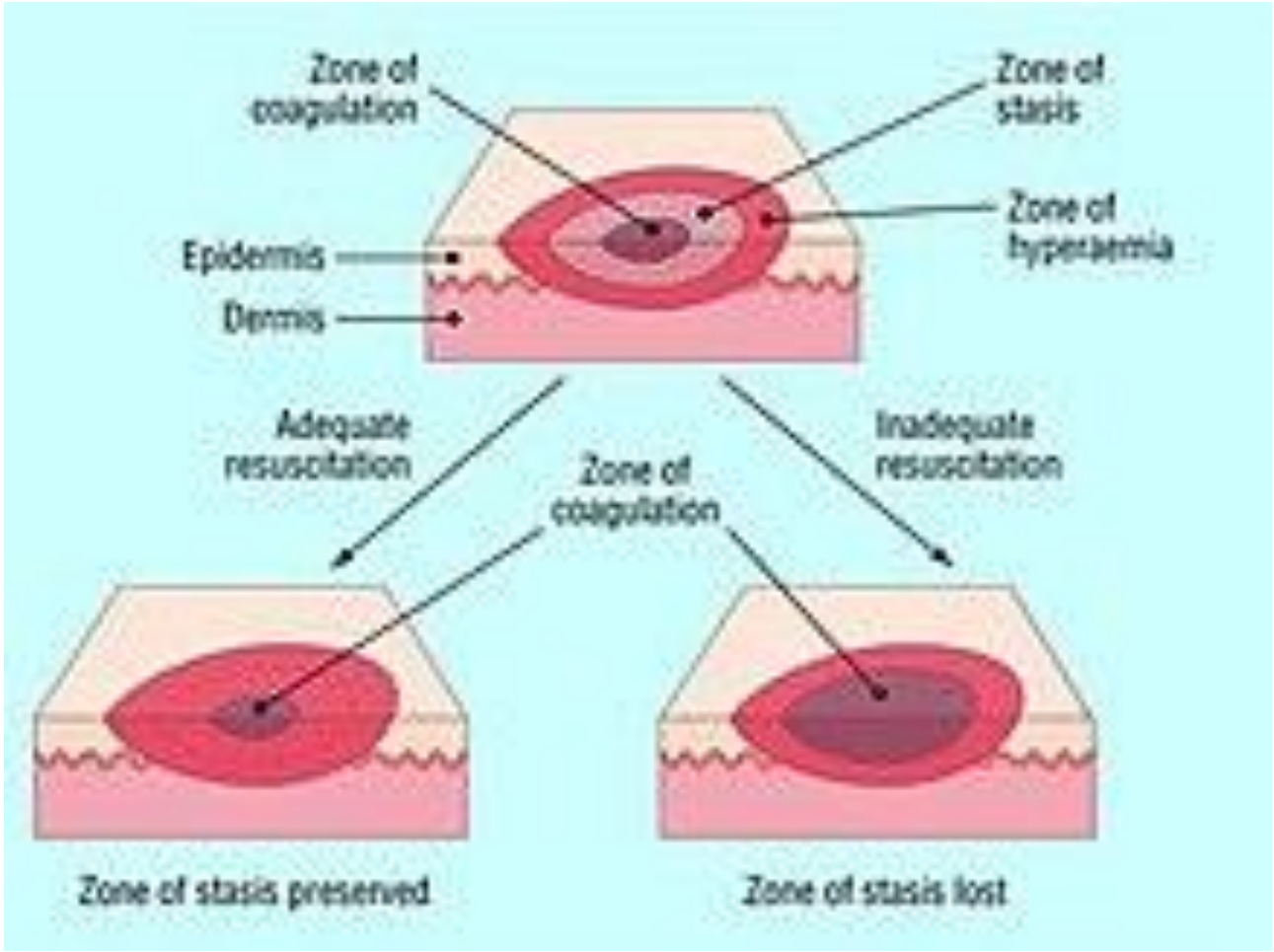
- Analgesia
- Nasogastric drainage
- Tetanus prophylaxis
- Beware of other injuries
- Beware electrical burns
- Consider escharotomy

TRANSFER TO BURN UNIT

- Greater than 15% burns in an adult –
- Greater than 10% burns in a child –
- Any burn in the very young, the elderly or the infirm
- - Any full thickness burn –
- Burns of special regions: face, hands, feet, perineum –
- Circumferential burns –
- Inhalation injury –
- Associated trauma or significant pre-burn illness: e.g. diabetes

Table 10. Burn Unit Referral Criteria.

1. Partial-thickness burns greater than 10% TBSA
2. Burns that involve the face, hands, feet, genitalia, perineum, or major joints
3. Third-degree burns in any age group
4. Electrical burns, including lightning injury
5. Chemical burns
6. Inhalation injury
7. Burn injury in patients with preexisting medical disorders that could complicate management, prolong recovery, or affect mortality
8. Any patients with burns and concomitant trauma (such as fractures) in which the burn injury poses the greatest risk of morbidity or mortality
9. Burned children in hospitals without qualified personnel or equipment for the care of children
10. Burn injury in patients who will require special social, emotional, or long-term rehabilitative intervention



BURN DRESSING

REMEMBER THE THEORY OF JACKSON'S BURN WOUND MODEL

- The inner zone of a burn is the zone of coagulation:
- This area is dead and nothing any clinician can do will bring it back to life.
- The outer zone of the burn is called the zone of hyperemia:
- This is a reactive zone of inflammation in response to the injury, which can occur with non-burn injuries such as trauma, and will return to normal within hours of the injury.
- The middle zone of the burn is called the zone of stasis, which is the target of good burns care, such as effective first aid and dressings.
- Good first aid and wound management can significantly reduce the need for skin grafting,[1] simply by giving this middle zone the chance to recover, rather than deepen and become part of the zone of coagulation.
- This model helps to explain the dynamic nature of burn injuries, and how an assessment of the burn at the time of injury can be different in terms of size and depth to an assessment of the same injury 48 hours later.

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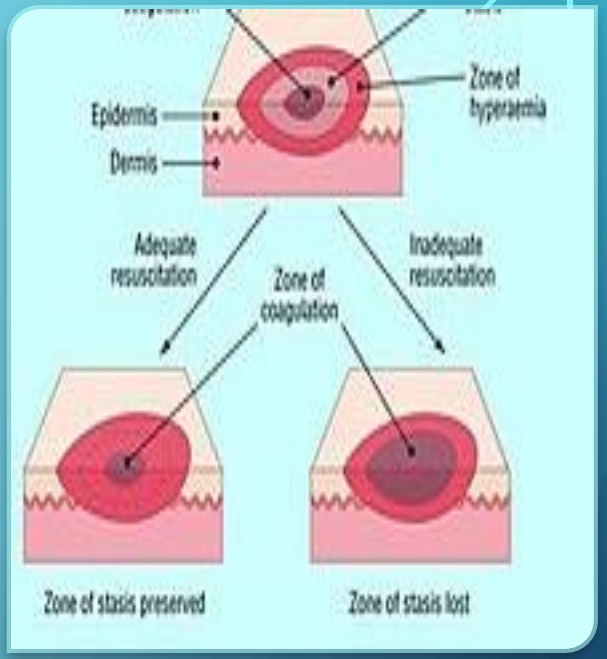

BLISTER DEBRIDEMENT

- The management of blister debridement is still controversial
- blister debridement for the following reasons:
- The build-up of fluid under the intact blister (which becomes firm and jelly-like quite rapidly) can put pressure on the underlying dermis, which in turn can reduce perfusion and potentially deepen burns.
- Blister fluid contains thromboxane B_2, a powerful vasoconstrictor that could reduce perfusion.-The blister skin is dead and should be removed as it is a potential focus for infection.
- The point of an antibacterial dressing is that it has contact with the viable skin – this is not possible if the blister is intact.
- Intact blisters are painful and reduce movement, which in turn increases swelling. Swelling of tissues increases the perfusion distance from capillaries to skin and this can reduce skin perfusion and deepen the burn.
- If the treating clinician is not experienced or confident in blister debridement, then ‘snipping’ the top of the blister with sterile scissors is recommended to de-roof it, encourage egress of the blister fluid and relieve pain.

THE OVERALL AIMS OF ANY BURN WOUND DRESSING, IRRESPECTIVE OF THE SIZE AND DEPTH OF THE BURN, INCLUDE:

- preventing infection
  promoting moist wound healing
  preventing conversion to a deeper burn
  reducing pain
  allowing for movement and function
  assisting in decreasing swelling

DRESSINGS :

- Use silver sulfadiazine (1% miscible ointment) with a single layer dressing. It has limited eschar penetration and may cause neutropenia.
- • Mafenide acetate (11% in a miscible ointment) is used without dressings. It penetrates eschar but causes acidosis.
- Alternating these agents is an appropriate strategy. •
- Treat burned hands with special care to preserve function. — Cover the hands with silver sulfadiazine and place them in loose polythene gloves or bags secured at the wrist with a crepe bandage; — Elevate the hands for the first 48 hours, and then start hand exercises; — At least once a day, remove the gloves, bathe the hands, inspect the burn and then reapply silver sulfadiazine and the gloves;

NUTRITION •

- Patient's energy and protein requirements will be extremely high due to the catabolism of trauma, heat loss, infection and demands of tissue regeneration. If necessary, feed the patient through a nasogastric tube to ensure an adequate energy intake (up to 6000 kcal a day).
- • Anaemia and malnutrition prevent burn wound healing and result in failure of skin grafts.
- Eggs and peanut oil and locally available supplements are good.

BURNS

THANK YOU

- Good luck