



Round : Major surgery

Group no : B8

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Burns

INTRO:

The integumentary system presents a large portion of the total body weight. Skin is the largest organ in the body, and it has multiple different functions:

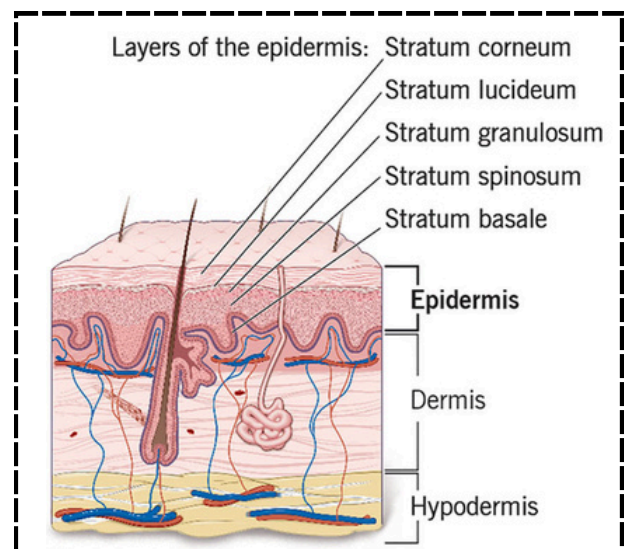
1. forms the first protective barrier against infections.
2. prevents excess water loss from the body.
3. regulates the body temperature.
4. contains different nerve endings that detect different sensations.

ANATOMY:

The skin has three layers, the epidermis, the dermis and the hypodermis:

Epidermis: it's the outermost layer, has five layers that are mainly made of keratinocytes in different developmental stages.

The epidermal layer also contains melanocytes that produce melanin to protect the skin against the harmful effects of UV light.



Dermis: the second layer, thicker than the epidermis and contains two layers:

- 1.: The papillary layer, which contains finger projections of fibroblasts that produce collagen and has appendages for pain and fine touch sensation.
2. The reticular layer, which contains elastin, collagen and accessory appendages of the skin (sebaceous glands, sweat glands and hair follicles). It also contains appendages for pressure and vibration sensations. It's rich in blood vessels and thus regulates body temperature.

Both layers in the dermis contain macrophages, blood vessels and nerve endings. The reticular layer provides some flexibility due to the skin and the papillary layer is responsible for our unique fingerprints, which are also important for gripping abilities)

Hypodermis: subcutaneous tissue that's made of adipocytes, macrophages, fibroblasts, lymphatics, nerves and blood vessels.

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BURNS:

Burn is regarded as multi-traumatic injury until proven otherwise. It leads to tissue destruction due to exposure to heat, radiation, electricity, chemicals or cold. Thus resulting in the following:

- loss of the anti-microbial barrier and increasing the risk of infection.
- impaired thermoregulation and water retention leading to dehydration.
- ☆ The survival of tissue depends on providing adequate blood supply, aseptic conditions and a moist environment.

When a patient comes to the clinic with a burn injury, perform a full traumatic survey.

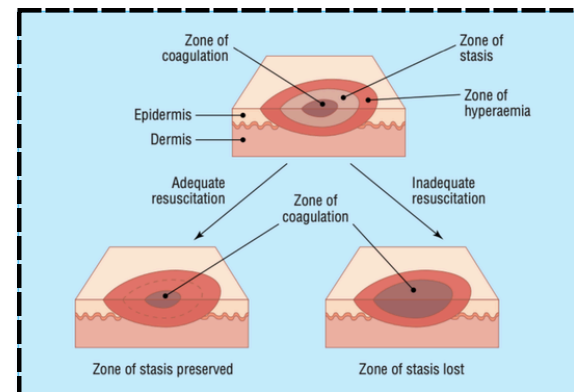
- primary (ABCDE)
- secondary (detailed history and physical examination)

ZONES:

Any burn has 3 histological zones:

1. Zone of coagulation: necrotic tissue/ not viable.
2. Zone of stasis: edematous tissue that has a low blood flow, undergoing progressive necrosis. it needs good management to prevent its progression to coagulative necrosis.
3. Zone of hyperemia: has good blood supply, hyperemia due to vasodilation and increased permeability.

☆ The larger the zone of stasis, the lower the number of surgical options that we have and the higher the risk of complications.



FACTORS:

We need to identify 2 factors regarding burn which will help us determine the interventions we are to do:

- the depth of the burn (the degree)
- the % of BSA affected (to determine the need for hospitalization)

☆ Burns could increase in depth and degree if a superimposed infection was established on the burn site, so we need an immediate measure to treat burn cases.

Burns

BURN DEGREE:

	SKIN LAYERS INVOLVED	CLINICAL FEATURES	HEALING
SUPERFICIAL BURN (1ST DEGREE)	Epidermis	Sensation intact → pain, erythematous, blanchable, hair follicles present	5–10 days: no scarring, heals completely
SUPERFICIAL PARTIAL THICKNESS BURN (2ND DEGREE)	Extends into superficial (papillary) dermis	Sensation intact → pain, erythematous, forms blisters containing clear fluid, blanchable, hair follicles present	2–3 weeks: spontaneously re-epithelializes
DEEP-PARTIAL THICKNESS BURN (2ND DEGREE)	Extends into deep (reticular) dermis	Yellow/white, no sensation, minor blanching, blisters, some hair follicles still intact	1–2 months: re-epithelializes, hypertrophic scars common, grafting recommended to expedite healing
FULL THICKNESS BURN (3RD DEGREE)	Extends through epidermis, dermis	No sensation, stiff leathery eschar (black/ grey/white/ cherry red in colour), no hair follicles, thrombosed veins visible	Incomplete/months: Re-epithelializes from wound edge, grafting necessary to replace dermal integrity, limit scarring
FULL THICKNESS BURN (4TH DEGREE)	Injury to underlying tissues (fat/muscle/bone)	Black/charred	Requires debridement/ amputation: skin flap for coverage, does not re-epithelialize, cannot graft

quick trick:

1st degree: redness, painful, nerves and appendages are intact.

2nd degree: extremely painful, blisters, hair follicles and sensation are preserved when it's superficial.

3rd degree: no sensation and no appendages. Eschar (dead tissue) and stiff, no elasticity and could appear whitish as it reached the subcutaneous tissue.

4th degree: full thickness so appears blackish and not viable.

ZONES:

Doesn't include areas with first degree/ superficial burns.

Relays on palm size estimation: size of individual's hand print (palm + fingers = 1% of TBSA). Then according to Wallace rule of nines: each major body area assigned value corresponding to the approximate proportion of body surface area it covers.

In children, back could be estimated to be 18 and each leg 14 instead.

	ADULTS	CHILDREN
LEFT ARM	9	9
RIGHT ARM	9	9
HEAD	9	18
CHEST	9	9
ABDOMEN	9	9
BACK	18	19
LEFT LEG	18	13.5
RIGHT LEG	18	13.5
GENITAL	1	1

INDICATIONS FOR HOSPITALIZATION

- Any full thickness burn
- Burns involving sensitive areas (face, neck, hands, axilla, perineum and feet)
- Burn in patients with co-morbidities
- Burn in patients with mechanical traumas (fractures/ require surgery)
- Burn in any patients living away from adequate qualified treatments for their injury.
- Burn in people with special needs, suspected neglect/abuse or suspected self-harm.
- Burn in extremities of age (less than 12 and more than 50) with less than 10% BSA burn.
- Second degree burns or more involving more than 10% BSA
- Any inhalational, electrical or chemical burns.

Burns

INHALATIONAL BURNS:

Inhalational burns carry the risk of sudden onset of angioedema which requires a rapid prophylactic intubation. Signs of it include:

- history related: excessive smokes and flames, burns in closed spaces and long contact time.
- physical related: facial burns (especially nose), loss of facial/nasal hair, coughing black sputum, stridor, hoarseness of voice, evidence of burns in the pharynx/oral mucosa.

☆ SIGNS are enough you don't need further assurance, intubate the patient prophylactically and be ready to perform Cricothyrotomy in cases of delayed intubation/evidence of edema in the neck.

ELECTRICAL BURNS

☆ Electrical burns require immediate admission to the ICU. We need to identify the inlet and the outlet which are mostly full thickness burns. Although the patient might come conscious and aware, they're at a great risk of sudden progressive deterioration.

1. They need 24 hours ECG monitoring due to high risk of developing cardiac arrhythmias.
2. They could develop seizures anytime.
3. We need continuous monitoring of urine output due to high risk of rhabdomyolysis which leads to myoglobinemia which's toxic to the kidneys and can lead to acute kidney failure.
4. They need fluid resuscitation.
5. They're at a high risk of developing compartment syndrome (increased pressure within large muscles that are surrounded by fascia leading to congestions, edema and compromised blood supply leading to rhabdomyolysis and kidney injury). It is treated with fasciotomy to release the compression as an emergency measure.

CHEMICAL BURNS

Exposure to corrosive substances (acids, bases, oxidizing/reducing agents, solvents, alkylants, chemical weapons)

- Severity of it depends on multiple factors. For example: greater volume, concentration, contact duration; specific mechanism of the chemical action, degree of tissue penetration.

Alkaline burns are far worse than acids, as our body does not have protective mechanism against it.

Burns

MANAGEMENT:

It differs from one type of burn to another. For example, in cases of chemical burns, we need to irrigate the affected area with low pressure water for some time. But in electrical burns, debridement (removing dead tissue and necrosis) is what we are to do after resuscitation and stabilising the patient.

FLUID RESUSCITATION:

Fluid resuscitation according to parkland formula ($4 \times \text{mass} \times \% \text{BSA}$)

- which's given over the first 24 hours following the burn. The first half is within the first 8 hours, and the second half during the rest 16 hours.

☆ Calculations start according to the time when the event happened not when the patient presented to the clinic. For example, if the incident happened before 7 hours, give 1/2 the amount of the fluid resuscitation within the next hour.

- Ringer's lactate is given because we need to resuscitation the patient and stabilize them. It's less likely to result in metabolic acidosis and it replaces the lost electrolytes and fluids treating the dehydration.

Colloids and other types of fluids could be given after 24 hours, when the vascular compartment has recovered.

Antimicrobial agent	Coverage	Advantages	Disadvantages
Silver sulfadiazine	Broad spectrum especially <i>Pseudomonas</i>	Soothing, no metabolic complication	Poor eschar penetration May impede epithelial cell migration (post-burn neutropenia)
Mafenide acetate	Broad spectrum including <i>Clostridium</i>	Good eschar penetration, excellent for both treatment and prophylaxis	Carbonic anhydrase inhibition with secondary metabolic acidosis, painful
Silver nitrate	Broad spectrum (gram positive and negative)	Excellent prophylaxis	Poor eschar penetration, hyponatremia, methemoglobinemia, black staining
Bacitracin	Gram-positive bacteria	Good for shallow facial burns	Expensive
Mupirocin	Methicillin-resistant <i>Staphylococcus</i>	Excellent for methicillin-resistant <i>Staphylococcus</i>	Very expensive
Acticoat	Broad coverage	Good for shallow burns, grafts and donor sites	Hides wound, non-adhesive and slips from wound

ANTIBIOTICS:

Antibiotics are given topically as we don't have good blood perfusion thus if given systemically it's less likely to be effective. We choose a broad spectrum antibiotic with good penetration. If the patient has co-morbidities/ immunocompromised, we can give systemic antibiotic to reduce the risk of sepsis.

- Anticoat is an important antibiotic, it has continuous release so less dressings are needed which promotes healing.

Burns

DRESSINGS:

We could either use biological dressings, which are rarely used like allograft and xenografts. Or Synthetic dressings like biobrane, trancyte and integra.

When changing the dressing, you need to apply antibiotic and clean the site which might result in delayed healing if it was adhesive dressing. So it's better to use long-releasing antibiotic in these cases.

SURGICAL MANAGEMENT:

1. Escharotomy: it's a full thickness incision that's made to release the compromised limb. It's mostly used in circumferential burns which constricts the burnt limb leading to compromising of the blood supply and increased risk of burn induced compartment syndrome development.
2. Excision of burnt eschar (debridement)
3. Grafting: surgical procedure to move tissue from one site to another on the body, without bringing its own blood supply with it.

COMPLICATIONS:

Burn complications can occur early (within the first week) or late (within the 1-3rd week) post-burn. These complications include:

1. Compartment syndrome.
2. GIT problems: paralytic ileus due to stress which leads to mechanical obstruction and curling ulcers.
3. RS problems: pneumonia
4. GU problems: renal failure due to hypoperfusion, or due to hypermyoglobinemia.
5. Systemic problems: shock due to hypoperfusion and sepsis.
6. Surgical complications: Graft loss and MSS related: contractures if affecting the joint, it could limit movement requiring physiotherapy and rehabilitation. we can treat it surgically with Z-plasty (a surgical z-shaped incision known as surgical release)
7. Death.