Burns

Pathophysiology

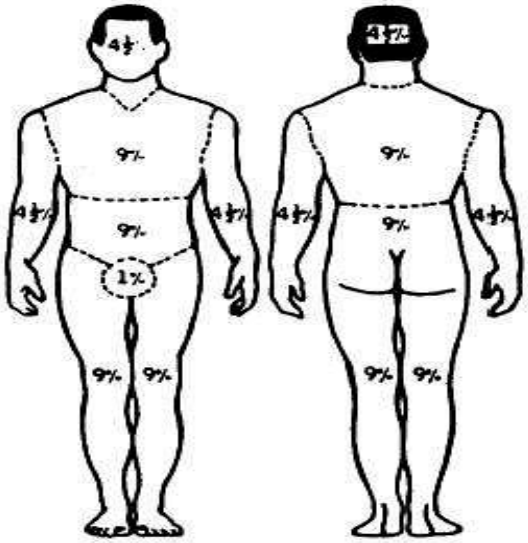
1. **Cell damage and death causes vasoactive mediator release:**
    a. **Histamine, thromboxane, cytokine**
2. **Increasing capillary permeability causes edema, third spacing and dehydration**
3. **Possible obstruction to circulation (compartment syndrome) and/or airway**

Causes

1. **Scalds**
2. **Fires**
    a. **85% of burn mortality**
3. **Chemical**
4. **Electrical**

Estimation of Burn Percentage

1. **< 15 years: Patients hand size used to measure burn is 1%**
2. **> 15 years: Rule of 9**
    a. **Head 9%**
        i. **Infants 18%, >1 year reduce 1%/year (until 9%)**
    b. **Each arm 9%**
    c. **Anterior trunk 18%**
    d. **Posterior Trunk 18%**
    e. **Perineum 1%**
    f. **Each leg 18%**
        i. **Infants 14%, >1yr add 1%/year (until 18%)**
3. **Rule of 9 Picture:**



Estimation of Burn Size and Depth

1. **1st Degree**
    a. **Epidermis is destroyed**
    b. **Sunburn, with or without blisters**

    c. Very painful
2. 2nd Degree
    a. Dermis is destroyed
    b. Very painful
3. 3rd Degree
    a. Subcutaneous fat destroyed
    b. Less painful
4. 4th Degree
    a. Bone and other structures are destroyed
    b. No pain

Estimation of Depth of Burn

1. The initial assessment of depth is unreliable
    a. Never predict depth to parents
2. For the purpose of fluid replacement: mild superficial erythema can be ignored
    a. Areas that are pink and blanch with pressure are usually superficial
    b. Dark red, mottled or pale waxy areas are deep
    c. Presence of pinprick sensation may help indicate superficial (as opposed to deep) burn

Grading of Burns

1. Minor: < 5% BSA (Body Surface Area)
2. Moderate: 5-15% BSA full thickness (may include special areas)
3. Severe: >15% BSA (95% of Burns = 50% mortality)
4. Special areas such as hands/fingers, feet/toes and perineum have small BSA but are considered moderate to severe because of potential disability

Management

1. Airway
    a. Oxygen for all burn patients
    b. Any respiratory complications consider PICU
    c. Most swelling occurs in first 24 hours to 3 days
    d. Clinical signs to watch for:
        i. Hoarseness, stridor, cough, and visible redness of pharynx
        ii. Overt respiratory distress or hypoxia
    e. Consider early intubation for thermal injury to airway, face and neck, inhalation injury and central nervous system (CNS) dysfunction
    f. For intubation use Vecuronium (no Succinylcholine due to possible high K+)
    g. Children burnt in confined spaces may suffer carbon monoxide poisoning
        i. Loss of consciousness, confusion or disorientation are likely signs

        ii. Give high concentration oxygen even if SaO2 is high (Carbon monoxide will bind with the hemoglobin causing a false SaO2 reading)
        iii. Consider carboxyhemoglobulin level
        iv. Consider hyperbaric oxygen
2. Fluid resuscitation and maintenance
    a. Two large bore IV's (might need to be sutured)
    b. Bolus with normal saline (NS) or lactated ringers (LR) to restore perfusion
        i. Blood pressure might be high due to high systemic vascular resistance (SVR) but perfusion poor
        ii. LR most often used because it has physiologic concentrations of Na+, K+, CL- & HCO3-
    c. Albumin in the first 12 to 24 hours may leak into the interstitium and can worsen tissue edema
    d. Goal is to normalize vital signs and maintain end organ perfusion thus improving capillary refill and urine output
    e. First degree burns: use normal maintenance formula (tissue and fluid losses are minor)
    f. Second and Third degree burns use Parkland Formula:
        i. LR 4cc/Kg x % burned over 24hrs plus maintenance
        ii. Give half of the volume in 8 hours
            1. Important: clock starts when burned occurred
        iii. Give second half in 16 hours
3. Foley placement
    a. Normal urine output > 1cc/kg
    b. Teenagers $\geq$ 30cc/hr
    c. If urine output is low – increase fluids
4. Pain control
    a. IV use of morphine, fentanyl or ketamine
    b. IM route not well absorbed
5. Wound control
    a. Clean with sterile normal saline or sterile water and cover with non-adherent dressing
6. Asses neurovascular status of circumferential burns
    a. Chest, limbs, fingers/toes
7. Keep patient warm
    a. Cover with warm blankets
    b. No ice packs- hypothermia causes more tissue injury
8. Chest X-ray
9. I-Stat on transport
10. Electrolytes, BUN, Creatinine
    a. Low K+ needs to be supplemented
    b. In compartment syndrome or excessive tissue burn: Rhabdomyolysis (skeletal muscle decompostion) can occur

causing a high K+, Phosphorus and CPK; low Ph and Ca+ are common

i. NaHCo3 1meq/kg will reduce the Serum K+ and damage to kidneys
ii. CaCl 10mg/kg will stabilize cardiac cell membrane and lower phosphorus

11. Tetanus booster should be given if tetanus is incomplete or if > 5 years have elapsed since last given
12. Transport to a Burn Center (UCSD)

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