

Thermal trauma

PRIMARY SURVEY:

- **AIRWAY** may be compromised by airway burns:
 - Face and neck burns
 - Singed eyebrows and nasal hair
 - Carbon deposits in the oropharynx
 - Carbonaceous sputum
 - Hoarseness
 - History of confinement in a burning environment
 - Explosion with burns to head and torso
 - Carboxyhemoglobin level over 10%

INTUBATE ANYBODY WITH SERIOUS AIRWAY BURNS AND CIRCUMFERENTIAL NECK BURNS

- **BREATHING** may be compromised by airway burns, and/or
 - Inhalation of toxic fumes leading to tracheobronchitis and pneumonitis
 - Oedema and pneumonia forms later
 - Carbon monoxide poisoning: look for the typical signs
 - Always assume some degree of CO poisoning. Get an ABG
 - Carboxyhemoglobin level of over 20% causes symptoms
 - 20-30% = headache and nausea
 - 30-40% = confusion
 - 40-60% = coma
 - over 60% = death
 - remember: PaCO of 1mmHg results in a carboxyhemoglobin concentration of 40%

Breathing may be restricted by anterior chest burns, not necessarily circumferential ones.

If spinal precautions permit, elevate them 30 degrees to prevent upper body oedema

- **CIRCULATION** basically involves getting IV access
 - **GET INTRAVENOUS ACCESS:**
 - fluid resuscitation for anybody with over 20% surface burns
 - if the burns are everywhere, don't be shy and put the cannula through burnt skin

ARE THEY STILL ON FIRE? PUT THEM OUT.

Also, hose off any chemicals that may be burning them, and remove melted/burnt clothing

ASSESSMENT OF THE BURNS PATIENT

- history of the accident

ESTIMATION OF THE BODY SURFACE AREA: RULE OF NINES

- Palmar surface and genitals = 1%
- Everything else = 9%
- Torso = 18%

DEPTH OF BURN

- **FIRST DEGREE: SUPERFICIAL**
 - Erythema, but no blisters
- **SECOND DEGREE: PARTIAL THICKNESS**
 - Wet burns, blistering, oozing, hypersensitive
- **THIRD DEGREE: FULL THICKNESS**
 - Dark, leathery, dry, with loss of sensation

RATE AND TYPE OF FLUID RESUSCITATION IN BURNS:

- Hourly urine output is the most reliable measure
- Adults should aim for 0.5ml/kg/hr, kids for 1ml/kg/hr

First 24 hrs: REPLACE 2-4 ml of Ringers lactate

- per kg of body weight, AND
- per percent of second and third degree burn surface area
- half in the first 8 hrs, the other half in the next 16 hrs

thus, a 100kg person with 40% surface burns = $100 \times (2-4) \times 40 = 8000$ to 16000 ml in first 24 hrs, of which 4000-8000 is given in the first 8 hrs

ADJUNCTS TO THE SECONDARY SURVEY:

- **BASELINE BLOODS:**
 - FBC
 - GROUP AND SCREEN
 - CARBOXYHEMOGLOBIN
 - GLUCOSE
 - ELECTROLYTES
 - B-HCG
- **CIRCUMFERENTIAL EXTREMITY BURNS:**
 - Remove all jewelry
 - Assess all distal pulses and cap refill, maybe even with Doppler
 - Get the surgeon to do an escharotomy; usually not necessary in the first 6 hours
 - Consider fasciotomy if needed
- **WOUND CARE:**
 - Partial thickness burns REALLY hurt even when a current of air passes over them
 - Do not break blisters
 - DO NOT apply cold water if the burns extend over more than 10% surface area
 - That can cause hypothermia

CHEMICAL BURNS

- Immediately hose them down, for 20-30 minutes
- ALKALI BURNS REQUIRE LONGER IRRIGATION

ELECTRICAL BURNS:

- FREQUENTLY MUCH WORSE THAN THEY APPEAR ON THE SURFACE
- Usually the big problem is deep muscle necrosis, where the current fried it
- Thus, rhabdomyolysis and acute renal failure results
- To maintain a high urine output (> 100ml/hr) you may need to give mannitol

COLD INJURY

- **FROSTNIP**
 - MILDEST form of cold injury
 - Initially, pain and pallor of the extremity, with NUMBNESS
 - Reversible with rewarming – does not result in tissue loss
 - Over many years of re-injury, atrophy will result, with fat pad loss
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- FROSTBITE

- Freezing of the tissue with intracellular ice crystals
- There is vascular occlusion, and thus ischaemia
- There is later a reperfusion injury which extends the damaged area
- There are degrees of frostbite, just like burns:
 - FIRST DEGREE
 - Hyperemia and edema without necrosis
 - SECOND DEGREE
 - Large clear vesicle formation
 - Partial skin thickness necrosis
 - THIRD DEGREE
 - Full thickness skin necrosis, some underlying tissue necrosis
 - Vesicles are usually hemorrhagic
 - FOURTH DEGREE
 - Full thickness necrosis with muscle necrosis and gangrene

- NON-FREEZING INJURIES

- Eg. when a limb is exposed to long term cold and wet, at just above freezing- from 1 to 10 degrees Celsius
- Usually due to microvascular occlusion with endothelial damage
- Stereotypical example is "Trench foot"
- The entire limb may appear black, but deep tissue is usually not destroyed
- First, the limb is cold and numb
- Then, it becomes hyperemic and painful
- Blistering, redness, echymosis follows
- Cellulites and gangrene may result

CHILLBLAIN (pernio)

- Manifestation of chronic repetitive cold and damp exposure, or long term dry cold exposure
- Typically affects the face, anterior tibia, dorsum of hands and feet
- SIGNS:
 - Pruritic purple-red lesions
 - Papules, macules, plaques or nodules
 - May progress to scarring
 - Itching may progress to pain
 - Annoying more than destructive
 - Benefit from calcium channel blockers and GTN

GENERAL MANAGEMENT OF COLD INJURIES

- WARM THEM UP
- Place the affected part in warm circulating water
- Continue warm water bath until pink and well perfused
- Do not rub or massage the area
- Rewarming is painful, give lots of analgesia

LOCAL WOUND CARE OF FROSTBITE

- THE KEY IS TO PREVENT INFECTION
- Do NOT open any vesicles
- Elevate the injured area
- Leave it open to the air
- Uninfected blebs and vesicles should be left intact for 7-10 days
- **AVOID VASOCONSTRICTORS** eg. tobacco
- Vasodilating agents are NOT USEFUL
- There has been some promise with thrombolytic agents
- Early debridement is usually not necessary, and the frostbite usually takes weeks to demarcate

MANAGEMENT OF SYSTEMIC HYPOTHERMIA

- DEFINITION: CORE TEMPERATURE BELOW 35 DEGREES
- In trauma patients, consider anyone hypothermic below 36 degrees
 - Cardiac output falls in proportion to the degree of hypothermia
 - Cardiac irritability occurs below 33 degrees
 - Ventricular fibrillation occurs below 28 degrees
 - Asystole occurs below 25 degrees
 - **CARDIAC DRUGS AND DEFIBRILLATION ARE INEFFECTIVE IN ACIDOSIS, HYPOXIA AND HYPOTHERMIA. They should be attempted at AT LEAST 28 degrees or above.**
 - **BRETYLIUM** is the only effective antiarrhythmic in hypothermia
 - **DOPAMINE** is the only effective inotrope in hypothermia

SIGNS:

- Reduced level of consciousness
- Cold to the touch (duh)
- Grey, cyanotic patient
- Depressed respiration, sometimes bradycardia

MANAGEMENT:

- ABCDE
- Continue CPR until the body is rewarmed
- You cant really pronounce anyone dead until you tried rewarming them:
YOU'RE NOT DEAD UNTIL YOU'RE WARM AND DEAD.