UC San Diego Health

Management of Burn Injuries

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UC San Diego Health
Regional Burn Center

Objectives

- Review epidemiology and mechanisms of burn
- Review depths of burns and how to calculate TBSA
- Understand the principles of fluid resuscitation and how to calculate Parkland Formula
- Review ABA Referral Criteria
- Know how to prepare burned patient for transfer

Epidemiology of Burns

- Burns and fires are the 3rd leading cause of accidental death in all age groups
- 2 million people a year are burned
  - 80% of these are less than 20% TBSA
  - 5,000 deaths per year
  - About 50,000-75,000 patients require hospitalization
  - 400+ admissions at UC San Diego per year
  - 3,500 outpatient visits per year at UC San Diego
- Children 4 years old or younger account for ½ of all pediatric burn admissions

Etiologic Types of Burns and Wounds

- Scalds
- Non-burn (SJS, Nec. Fasciitis, chronic wound)
- Electrical
- Open Flame
- Structural/Car Fire
- Friction/road rash
- Smoking

- Natural Gas Explosions
- Chemical
- Lightning strike
- Welding
- Self Inflicted/Suicide
- Assault
- Faulty Heating Equipment

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Scalds & Water Heater Temperature

Water Temperature	Length of Time to Receive a Severe Burn
156°	1 second
149°	2 seconds
140°	5 seconds
133°	15 seconds
127°	60 seconds
124°	3 minutes

Circumstances of the Burn

- What was the mechanism of a burn?
- Did the burn occur in a closed space or open space?
- Did the patient's clothing catch fire?
- What type of flame/chemical/liquid was involved?
- What was the length of contact time?
- What initial treatment did the patient receive?

House Fires

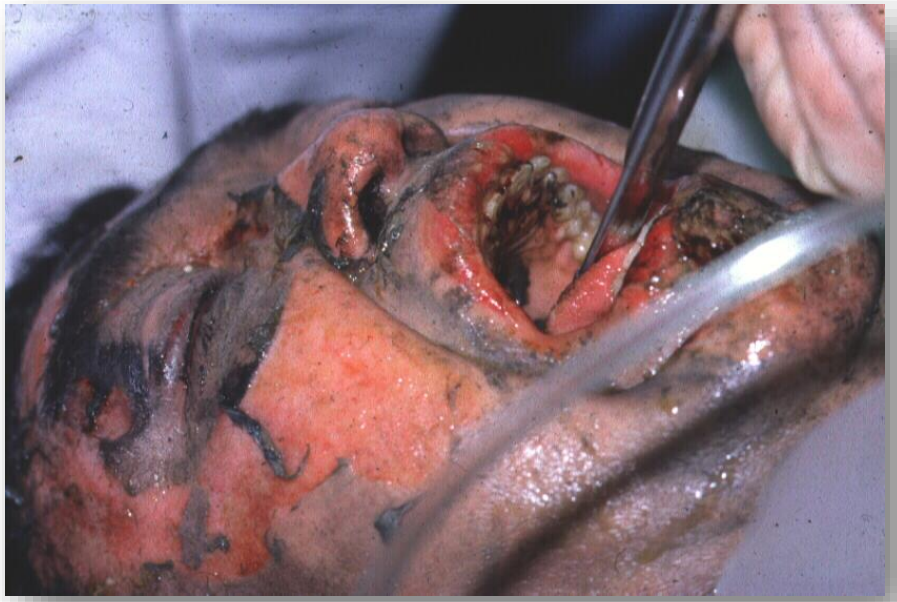
- 73 % of all burn fatalities are due to house fires
- 2nd leading cause of death in the home for all ages
- House fires account for only 4 % of burn admissions
- House fires carries a 12 % fatality rate of patients admitted to a burn unit
- 12 victims die each day due to a house fire

Automobile Fire

- Combustion of toxic materials can lead to the production of cyanide gas and carbon monoxide
- Conditions at the scene may yield critical information:
  - How badly were the occupants injured?
  - Associated blunt trauma injuries?
  - Closed space fire/inhalation injury?
- Combined ATLS/ABLS care

Smoke Inhalation Injury

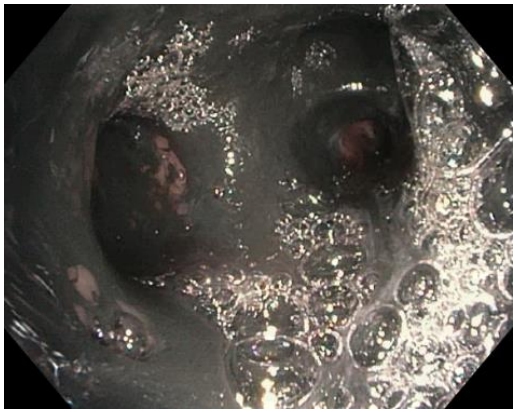
- Smoke consists of combustible products, asphyxiates and carbonaceous debris
- Greater effect on mortality than either patient age or surface area burned
- Inhalation injuries present in 25-50 % of burn patients
- Identified in 60-70% of patients who die in burn centers

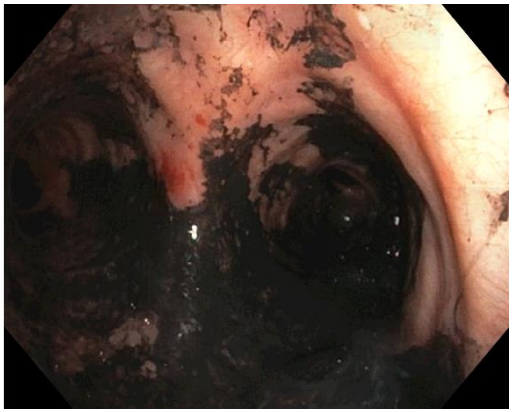
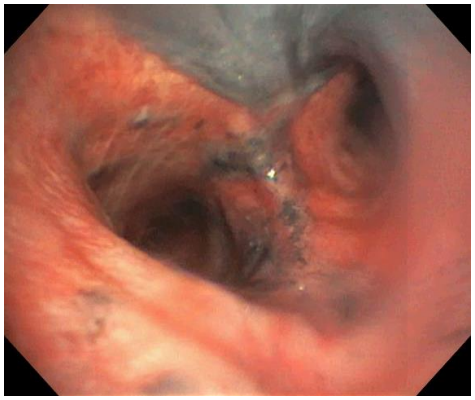


Clinical Signs of Inhalation Injury

- Upper airway edema is the earliest consequence of inhalation injury
- High index of suspicion, (ie. fire in a closed space)
- Concurrent oral pharyngeal or facial burns
- Carbonaceous deposits/soot in oropharynx or nares
- Patient with an impaired sensorium or agitation
- Hoarseness, tachypnea, dysphagia

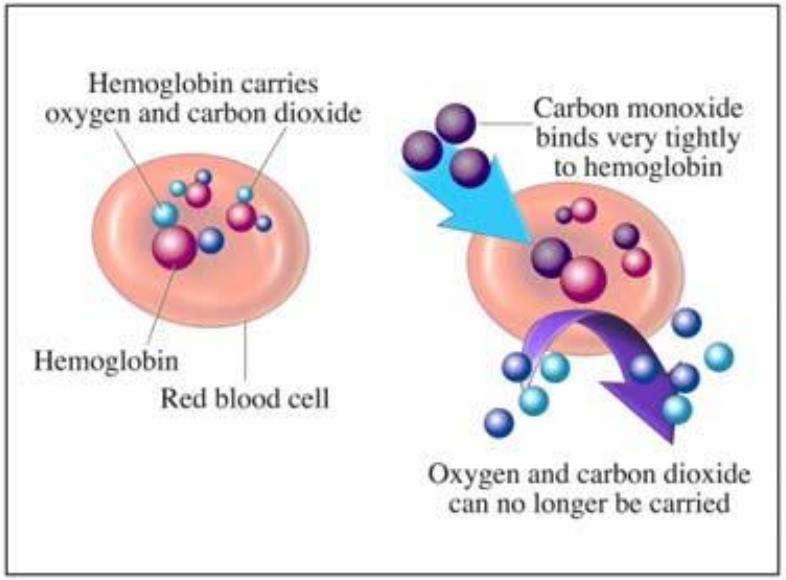
Smoke Inhalation Injury




Pathophysiology of CO Poisoning

- CO displaces O_2 on the hemoglobin resulting in decreased arterial O_2 content
- CO binds to Hgb with 200 x more affinity than oxygen, decreasing cellular respiration
- The more Hgb is bound to CO, the more likely that tissue hypoxia will occur
- Systemic and cerebral hypoxemia most devastating side effects



Carbon Monoxide Poisoning

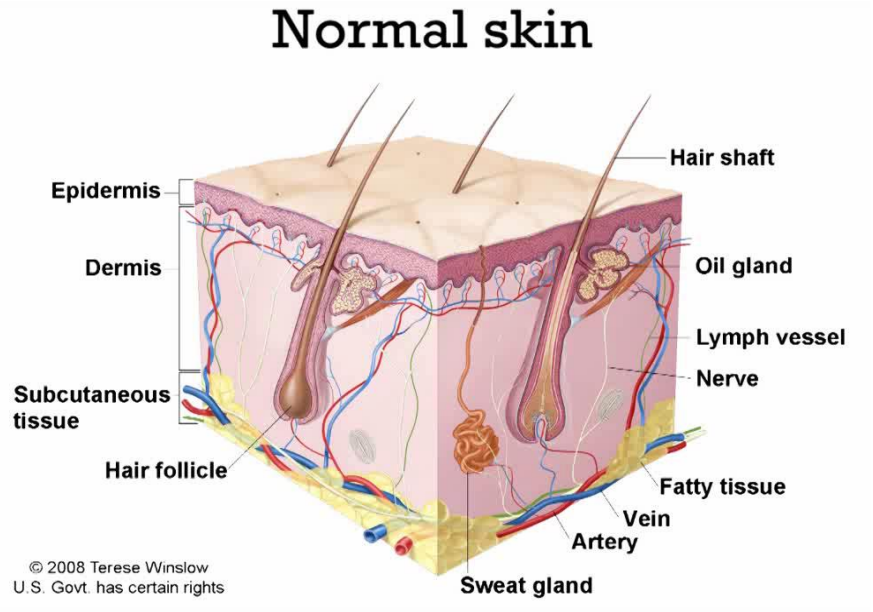
COHgb	Symptoms
10%	Asymptomatic, headache
20%	Dizziness, nausea, dyspnea
30%	Visual Disturbances
40%	Confusion, syncope
50%	Seizures, coma
>60%	Cardiopulmonary dysfunction and death

Treatment of CO Poisoning

- Supplemental oxygen by 100% face mask or intubation
  - Mean ½ life of CO at room air is 4 hours
  - On 100 % oxygen, ½ life is 1 hour
  - With HBO, ½ life is 20 minutes
- Patients with high carboxyhemoglobin levels should receive 100 % oxygen until levels are less than 10 %
- Hyperbaric O_2, if available, and the patient is showing physical signs or symptoms

Burn Wound Depth

- First degree (Superficial)
- Second Degree (Partial Thickness)
  - Superficial partial thickness
  - Deep partial thickness
- Third Degree (Full Thickness)
- Fourth Degree



Superficial Burn

- Not included in TBSA
- Superficial burns
- Involves the epidermal layer of the skin
- Red, hypersensitive
- Topical treatment with emollients
- Spontaneous resolution in days

Superficial - Partial Thickness Burns

- The entire epidermis is involved and variable portion of the dermis
- Painful
- Spares the appendages
- Heals in 2-3 weeks (depending on depth of dermal injury)

Deep - Partial Thickness Burns

- Full epidermal involvement
- Deep dermal involvement
- Possible involvement of the dermal appendages
- May need grafting
- Scarring is minimal if healing occurs within 2-3 weeks.

Deep - Partial Thickness Burns

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Full Thickness Burns

- Destruction of the entire epidermis and dermis, including the appendages
- White, charred, dry, translucent, leathery
- May see coagulated vessels
- Excision and grafting will be needed
- Insensate

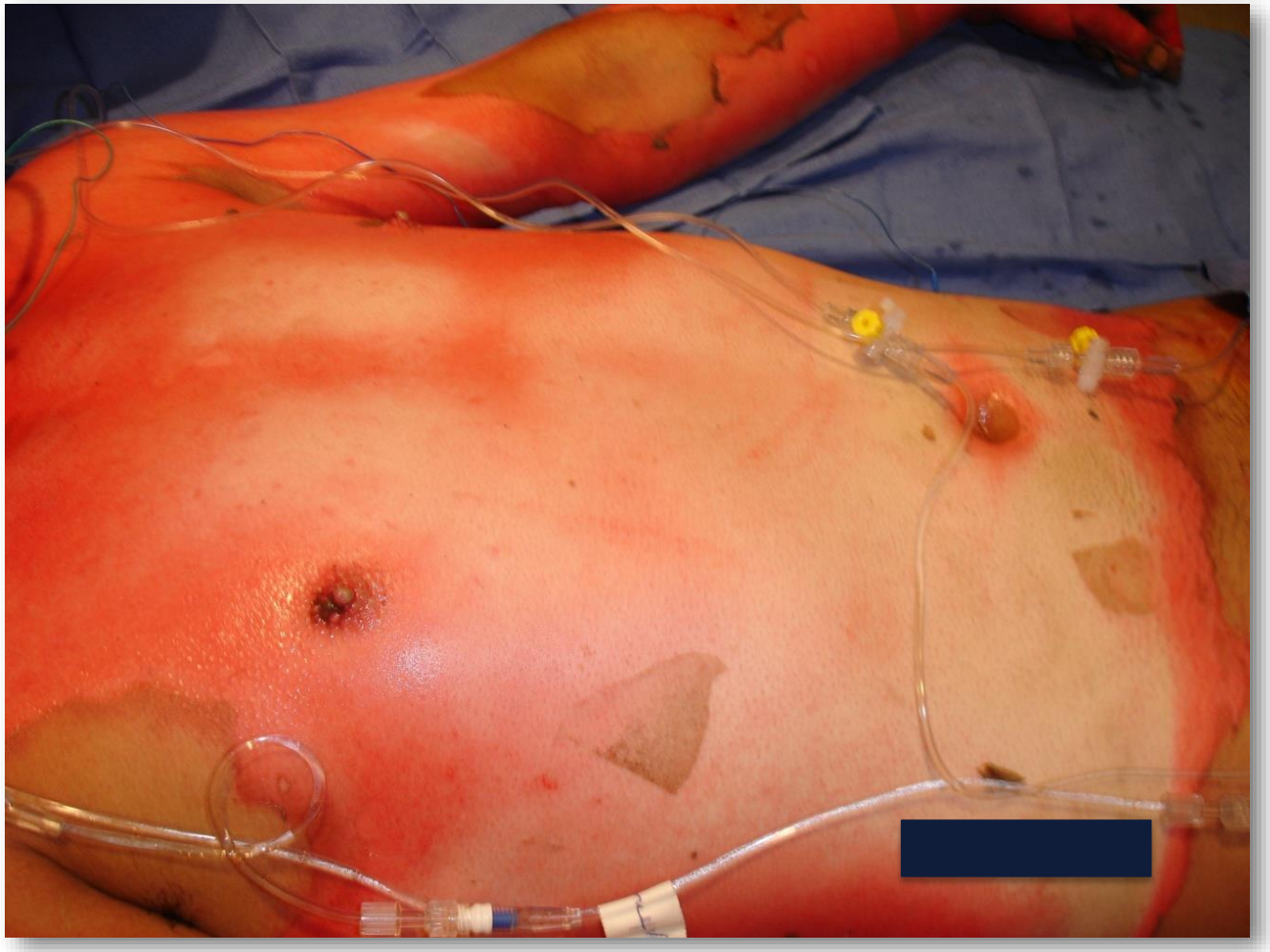
Full Thickness Burns

Full thickness/ 4th degree burns

- Full thickness burns due to electrical injury
- 4th degree burn often found in these injuries

Full thickness/ 4th degree burns

Combination of all…



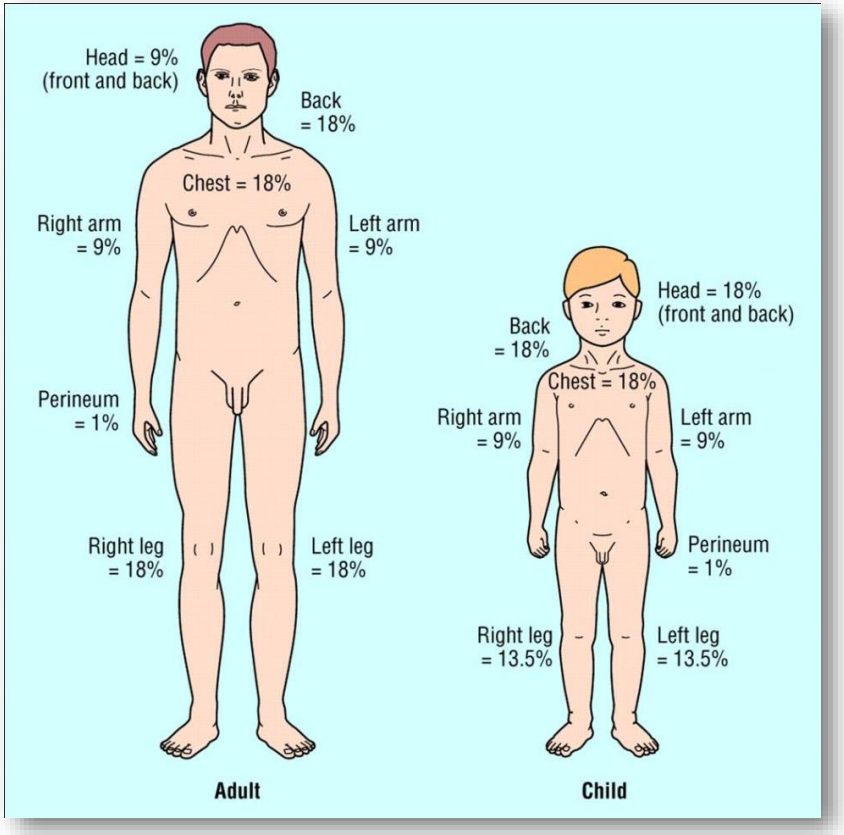
Child Abuse due to “Dipping”

Child Abuse with an Iron

- Injuries most frequently associated with child abuse are contact burns or scald injuries.
- Alerting factors:
  - History of injury
  - Compatibility of the history
  - Physical aspect of the injury
  - Evidence of multiple injuries

Determining the extent of a burn

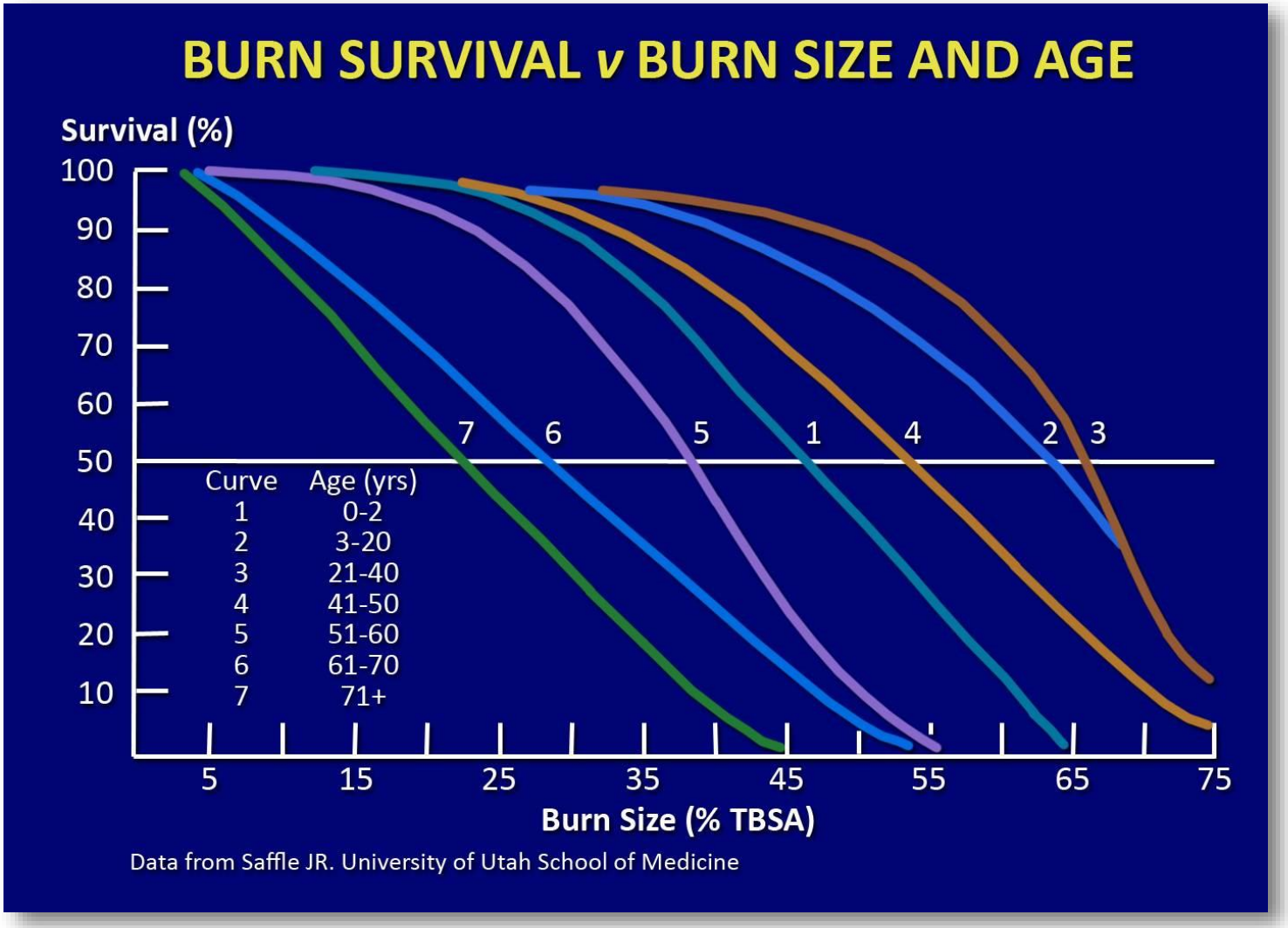
- Extent of burn
  - Estimating scattered burns of limited extent
- Depth of burn
  - Dictates treatment
- Rule of nines



Palm Method

- **Patient's** palmar surface (hand and fingers) = 1% TBSA
- Only include 2nd and 3rd degree wounds

Burn Survival



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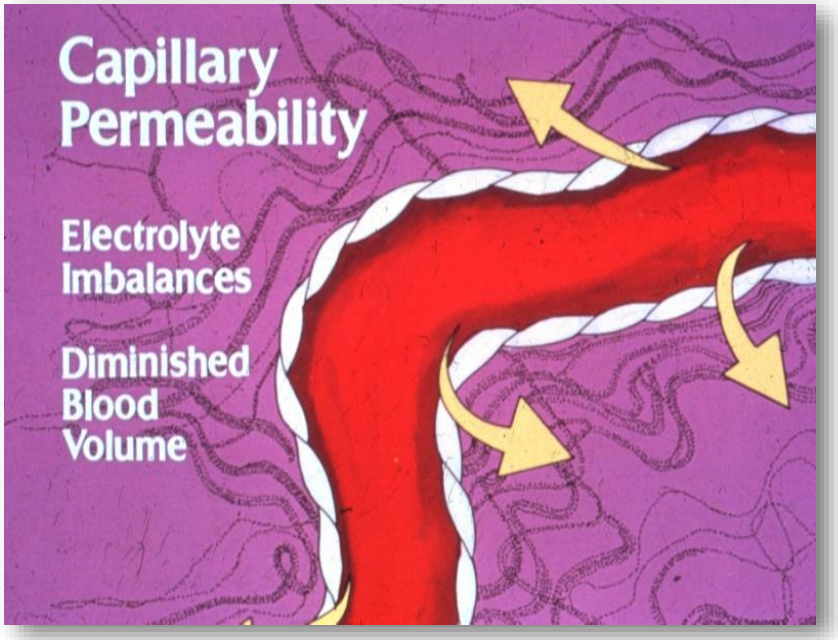
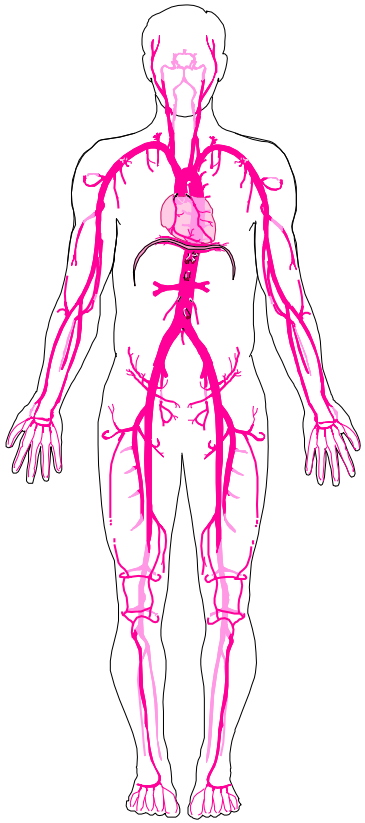
Burn Shock

- In thermal injury there is obligatory burn wound edema which is unique to burns
- There are hemodynamic changes which include decreased vasomotor tone, tachycardia, hypotension and oliguria
- Maximal edema formation occurs in about 8 hours in smaller burns and in 12-24 hours in larger burns
- The rate of progression of the tissue edema is dependent upon the adequacy of resuscitation



Burn Management Principles
Fluid Resuscitation

- The Parkland Formula is the standard for calculating fluids in the initial post burn period
- Goals: to maintain adequate tissue perfusion to limit the size and depth of the wound and to support the hemodynamics to the patient
- Individual patient's response to resuscitation should be used as the guide to add or withhold fluid



Fluid Resuscitation
Parkland Formula

- For adults:
  - % TBSA X Body weight (KG) X 2-4 ml LR.
  - Give the first ½ over 8 hrs, followed by the second half over the remaining 16 hrs
- For children:
  - Greater surface area per unit body mass necessitates greater amounts of fluid
  - 3-4 ml X weight (kg) X % TBSA burn
  - Children have low storage of glycogen and require a constant source of glucose
  - Continue with maintenance fluids containing dextrose:
    - 0 - 10 kg = 4 ml/kg/hr
    - 11-20kg = 2 ml/kg/hr
    - 21 kg and up = 1 ml/kg/hr

Fluid administration routes

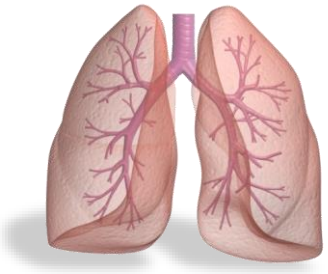
- Peripheral IV
  - Percutaneous, 2 attempts, preferably in unburned areas
- Central line
  - Femoral single lumen, subclavian
  - Intraosseous infusion

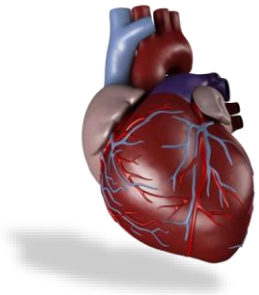
Monitoring Fluid Resuscitation

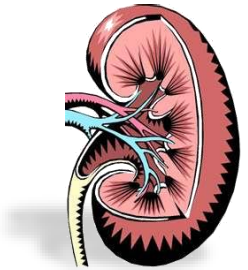
- Blood pressure
- Pulse
- Urine output
  - 0.5 ml/kg/hr (adult)
  - 1-2 ml/kg/hr (children)
- Mental status
- Acid-base status-follow the base deficit, HCT, Electrolytes

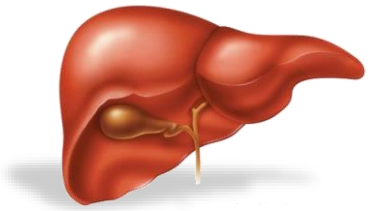
Delays in Fluid Resuscitation

- Delays in fully resuscitating a large burn patient can be devastating
  - Shock and organ failure
- In burns >80% a delay in only 2 hours in fluid resuscitation exponentially increase the systemic response by primed white blood cells.









Example
Adult Fluid Resuscitation

- 38 YO male involved in a flash flame burn when he attempted to light a propane tank, and it exploded
- He weighs 88 kg
- No other trauma or evidence of inhalation injury
- VS stable

Example
Adult Fluid Resuscitation

- Parkland formula:
- 40 % TBSA X 88 kg X 4= 14080
- **First ½** to be delivered in **first 8 hours** =7040 ml or **880 ml/hour**
- Second 1/2 over next 16 hours = 440 ml/hr.
- Monitor patient and adjust fluid as necessary

American Burn Association Referral Criteria

1. Partial thickness burns greater than 10% TBSA
2. Third degree buns in any age group
3. Burns that involve the face, hands, feet, genitalia, perineum or major joints
4. Electrical burns including lightning injury
5. Chemical burns
6. Inhalation injury
7. Any patient with burns and concomitant trauma (such as fractures) in which the burn injury poses the greatest risk of morbidity or mortality
8. Burn injury in patients with preexisting medical disorders that could complicate management, prolong recovery or affect 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 rehabilitative intervention

Why transport?

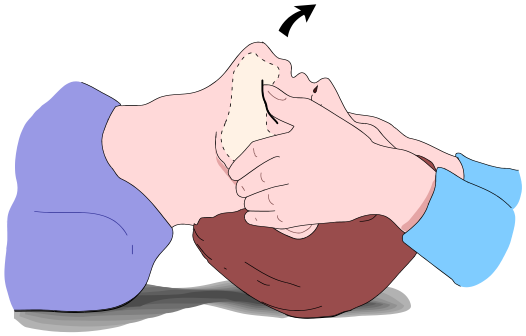
- Burn Units are highly specialized
- We treat both adults and children
  - Infants and elderly patients are less tolerant of burns
- Multidisciplinary approach
  - SW, Child Life Specialists, Nutrition, Psychology, Peds Critical Care, OT/PT, Case Managers….
  - Significant influence on outcome for major burn and electric injuries

How to transport
Pre-hospital Care

- Remove patient from source of injury
  - Make sure the scene is safe!
- Remove burning and burned clothes
- Remove everything that can develop constriction ring
- Cool with water
- Chemical burns - brush off powders, constant irrigation

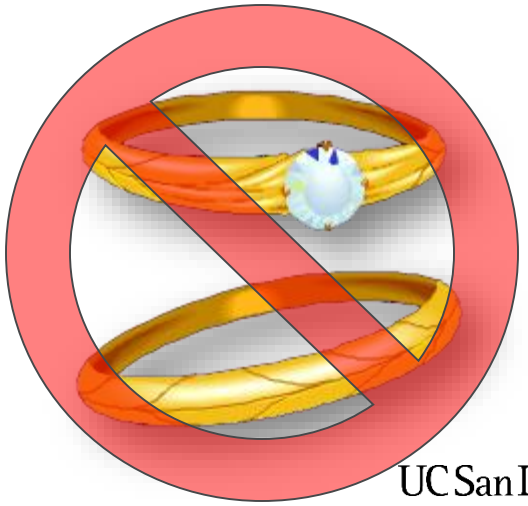
Stabilizing the patient

- ABCDE
  - Airway
    - C-spine control
  - Breathing
    - Listen, assess, provide O2 via NRB mask
    - Watch out for circumferential burns of the trunk
  - Circulation
    - Monitor blood pressure, pulse, skin color, circulation problems (cap refill, compartment syndrome)
    - Insert IV



Stabilizing the patient

- Disability, Neurologic Deficit
  - AVPU
  - Consider associated injury (CO2 poisoning, substance abuse, hypoxia, comorbid conditions)
- Exposure/Environmental Control
  - Remove all clothing and jewelry to complete primary and secondary surveys
  - Maintain patient's temperature



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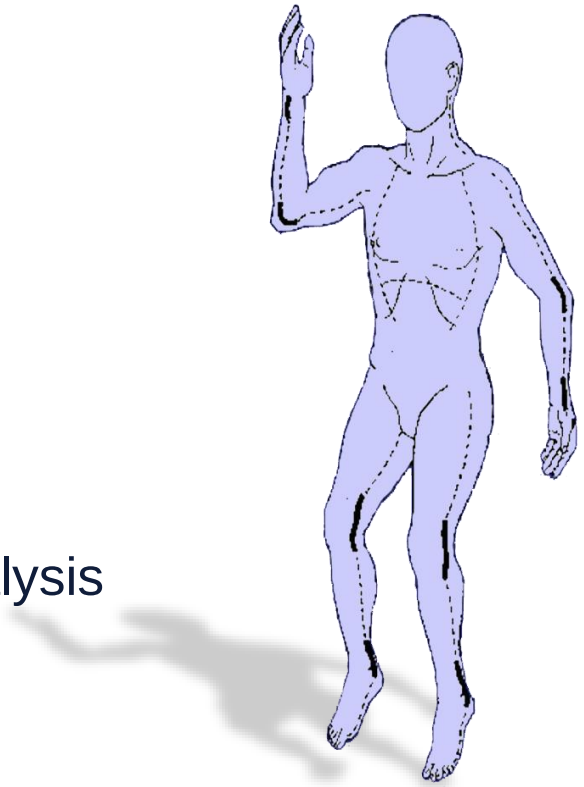
Stabilizing the patient
Protect the Airway

Escharotomies and Fasciotomies

- A circumferential partial thickness or full thickness burn may cause vascular compromise
- This may worsen with fluid resuscitation
- Can occur on the extremities or on the chest and neck
- Early recognition of this process will prevent a compartment syndrome
  - Identify signs and symptoms
  - Pallor, Paresthesia, Pulselessness, Pain, Paralysis
- Rarely indicated prior to transfer



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How to transport?
Preparing the patient

- NG tube

- Fluid management
  - Urethral patency
  - Cleanliness
  - Foley Cath for 20% or greater

How to Transfer?
Pain Control

- Obviously, pain is a huge factor in caring for burn patients.
- If transporting patients via EMS or flight, medicating with IV meds is appropriate.
- If transport by private vehicle, providing PO narcotic pain control is appropriate.
- If debriding a wound in the ED, providing PO narcotics is usually sufficient for a quick debridement and cleaning of a wound!

How to transfer?
Preparing the wounds

- The goal of burn wound management is to provide an environment of optimal wound healing
- Debride bullae, necrotic skin and foreign bodies
- Cover small burns with an antimicrobial or biologic agent
- Ensure thermoregulation for transport
  - Cover big burns with warm, dry sheets/blankets
  - Warm IVF (37-40 degrees)
- Burn wound excision and coverage
  - Performed at receiving Burn Center

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Transportation

- Ground transportation appropriate
- Helicopter transport is of greatest value for distances more than 30 miles or patient's condition warrants
- Should have trained personnel and equipment

Who to call?

- 619-543-6502 BICU
- 619-543-6505 Burn Clinic
- 24 Hours a day
- 7 days a week
- 365 days a year!!!!!!!!!!

QUESTIONS??