Burn Injuries

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Basic Demographics

- Hard to estimate statistics for Vietnam
- 2 million burns require medical attention each year in the USA



Basic demographics

- 14,000 deaths
- Most deaths are due to smoke inhalation
- House fires responsible for 50% of deaths



- Skin is the largest organ of the body
 - 0.25 m² in children
 - 1.8 m² in adults
- It is also the most exposed organ



Skin Layers

- Epidermis
 - Tough protective barrier

Dermis

- Contains blood vessels, nerve endings
- Prevents water loss due to evaporation
- Prevents loss of body heat



Functions of Skin

- Protection Heat regulation
- Sensory perception
- Excretion
- Vitamin D production
- Expression
 - important with body image
 - fear of disfigurement



Depth of Burns

- May be difficult to determine
- In some cases, may not be known until after healing has occurred



Traditional Classification

- 1st degree
- 2nd degree
- 3rd degree

Traditional Classification

Criteria	2 nd Degree	3 rd Degree
Cause	Hot liquid	Flame
	Flame	Electricity
		Chemicals
Color	Pink or red	Dark brown
		Black
		Charred
Surface	Vesicles	Dry
		Inelastic
Pinprick	Painful	Anesthetic



Alternative Classification

- Partial Thickness
 - Superficial
 - Deep
- Full thickness



Partial Thickness

- Characterized by varying depth from epidermis (outer layer of skin) to the dermis (middle layer of skin)
 - Superficial includes only the epidermis
 - Deep involve entire epidermis and part of the dermis
 - Generally heals spontaneously



Full Thickness

- Includes destruction of epidermis and the entire dermis as well as possible damage to the SQ, muscle and bone
 - Requires skin graft



Determining Severity of Injury

- Size (surface area)
- Depth
- Age
- Prior status of health of victim
- Location of burn
- Severity of associated injury



Pathology of Burns

- Burns will cause rapid loss of intravascular fluid and protein
- Volume loss is greatest in first 6-8 hours



Metabolic Response to Burns

As with any other major injury:

- Body secretions of catecholamine, cortisone, ADH, aldosterone and glucagon
- Profound hypermetabolic state that requires excess nutrients and oxygen
- Evaporative water loss from burn wounds may reach 300 cc/m²/h (normal = 15)
- Heat loss may reach 580 Kcal/hour



Fighting the Metabolic Response

- Aggressive nutritional support
- Rapid wound closure
- Control pain and stress
- Prevent sepsis



Hypovolemic State: First 48°

- Rapid fluid shifts
- Capillary
 permeability with
 burns increases with
 vasodilation
- Fluid loss deep in wounds
- Metabolic acidosis

- Protein loss
- Hemoconcentration
 - Hct increases
- Low blood volume, oliguria
- Hyponatremia
- V K -- damaged cells release K

Diuretic Phase: 48-72° After Injury

- Capillary membrane integrity returns
- Edema fluid shifts back into vessels - blood volume increases
- Hemodilution low Hct, decreased potassium as it moves back into the cell or is excreted in urine with the diuresis

- Fluid overload can occur due to increased intravascular volume
- Metabolic acidosis -HCO3 loss in urine, increase in fat metabolism
- Increase in renal blood flow - result in diuresis (unless renal damage)

General Indications for Fluid Resuscitation

- Burns > 20% of BSA with adults
- Burns > 10% of BSA with children
- Age > 65 or < 2</p>



- Airway
- Breathing
- Circulation
- Analgesia

- Assessment:
- Objective
 - how burn occurred, when
 - Duration
 - type of agent
- Subjective:
 - previous medical problems
 - size and depth of burn
 - age
 - body part involved
 - mechanism of injury



- Ventilation
- Esharotomy
- Establish IV access with large bore IV catheters
- Foley catheter
- Nasogastric tube
- Routine labs (blood count, electrolytes)



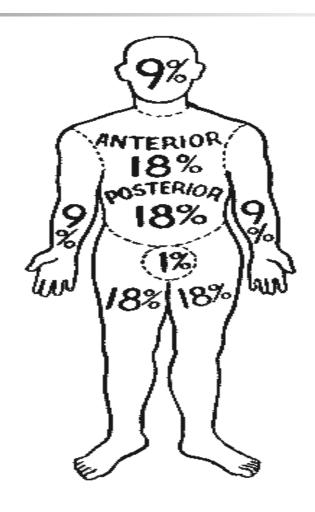
- Replace fluid loss with large amount of crystalloid
 - 3-4 cc/kg of body weight PER % burns
- Carefully observe:
 - Urine output
 - State of consciousness
 - Blood pressure



Parkland Formula

- First 24°:
 - 4 mL Lactated Ringer's X weight in kg X % total body surface area burned
- 50% of fluid in first 8°
- 50% over next 16°
- Keep urinary output .5 1 mL/kg/°

Rule of 9: Estimating % Burns





- Clear sensorium
- Pulse < 120 beats per minute</p>
- Urine output for adults 30 50 cc/hour
- Systolic blood pressure > 100 mm Hg
- Blood pH within normal range 7.35 -7.45

Acute Resuscitation: Crystalloids

Isotonic

- most common are lactated Ringers or NaCl (0.9%)
- these do not generate a difference in osmotic pressure between the intravascular and interstitial spaces
- subsequently LARGE amounts of fluid are required



- Hypertonic salt solutions
 - create an osmotic pull of fluid from the interstitial space back to the depleted intravascular space
 - helps decrease the amount of fluid needed during resuscitation
 - decreases the development of edema, pulmonary edema, and CHF



Acute Resuscitation: Colloids

- Replacement begins during the second 24° following the burn to replace intravascular volume
- Once capillary permeability significantly decreases



- IV fluid should consist of glucose in water and plasma to maintain adequate circulating volume
- Calorie and protein needs may be twice normal
 - Oral feeding if possible
 - Parenteral (IV) feeding may be necessary



Post-Resuscitation Period

- Antibiotic use is controversial
- Vitamin C
- Vitamin A



Wound Care Principals

- Goals
 - close wound
 - prevent infection
 - reduce scarring and contractures
 - provide for comfort
- Wound cleaning
- Debridement
 - mechanical
 - surgical
- Topical antibacterial therapy



Topical Antibacterial Agents

- Silvadene cream
 - Transient leukopenia
- Sulfamyalon
 - Metabolic acidosis
 - → Pain
- Silver nitrate
 - → Water toxicity

Dressing the Burn: Open Technique

Partial thickness

- exudate dries in 48 to 72 hours forming a hard crust
- epithelialization occurs beneath the crust and may take 14 to 21 days to heal
- crust then falls off spontaneously

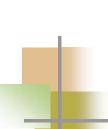
Full thickness

- dead skin is dehydrated and converted to black leathery escar in 48 to 72 hours
- loose escar is gradually removed



Dressing the Burn: Closed Technique

- Wound is washed and sterile dressings changed each shift or daily
- Dressing consists of gauze wraps and ointments if available



Dressing the Burn: Semi-Open Technique

- Consists of covering the wound with topical antimicrobial agents and gauze
- Advantages:
 - speeds debridement
 - develops granulation tissues faster
 - makes skin grafting possible sooner



Biological Dressings

- Homografts
 - same species (cadaver skin)
 - temporary coverage
- Heterografts
 - another species (pig skin)
 - temporary coverage
- Autografts
 - patients own skin
 - permanent coverage



Wound Care: Grafting

- Indications for grafting
 - full thickness burns
 - priority areas
 - wound bed pink, firm, free of exudate
 - bacterial count < 100,000/gram of tissue</p>
- Care of grafts assess



Rehabilitation

- Care of healing skin
 - Wash daily
 - Keep clean and dry
- Pressure garments
 - Prevent scaring and contractures
- Promote mobility



Inhalation Injuries

- Major cause of death from burn injury
- Direct inhalation of dry heat cause
 - Burn injury of upper airway
 - Rarely occurs below the level of the vocal cords
- Treatment
 - Endotracheal intubation
 - Tracheostomy

Inhalation Injury: Carbon Monoxide

- Should be considered when accident occurs in a closed space
- Symptoms
 - Headache
 - Confusion, Hallucination
 - Mild dyspnea
 - Coma
- Treatment
 - 100% oxygen